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ABSTRACT

This formative study is based on focus group interviews with nearly 200 teachers at 30 Iowa high schools during the spring of 1998. During the one-day site visits at each school, data was also collected from students, the principal, the technology coordinator (where available), and the district's technology plan. Teachers were asked about how they use technology, how they define technology integration, what motivates them to integrate technology, what barriers they face, how technology is changing teaching and learning, and what they believe the future holds for technology in education. Findings indicate Iowa teachers are progressing well with instructional technology integration. Iowa is ahead of the national average with most types of technology in the schools, including the ratio of students to computers. Teachers see computer technology as a tool to help them better accomplish their educational goals. The enthusiasm teachers have for learning is the biggest factor motivating them to integrate technology into the curriculum. Students are also enthusiastic about using technology, and teachers say this translates into increased learning of content for students. Teachers everywhere face difficult barriers as they attempt to integrate technology, including inadequate training, inadequate access to technology, and lack of time to learn and use technology. Despite barriers, technology makes it possible for teachers to become facilitators of learning rather than lecturers. Both teachers and students are taking more responsibility for their own learning, and there are more opportunities for individualized and hands-on learning. (Contains 72 references.) (AEF)

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Computer technology integration in Iowa high schools:
Perceptions of teachers

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by

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ABSTRACT

Over the past decade, Iowa schools have received substantial federal and state support for the integration of technology. These efforts have included staff development, hardware and software, and technical support. But has this really changed teaching and learning in Iowa schools?

This formative study is based on focus group interviews with nearly 200 teachers at thirty Iowa high schools during the Spring of 1998. During the one-day site visits at each school, data was also collected from students, the principal, the technology coordinator (where available), and the district's technology plan. During the one-hour focus group sessions teachers were asked about how they use technology, how they define technology integration, what motivates them to integrate technology, what barriers they face, how technology is changing teaching and learning, and what they believe the future holds for technology in education.

Findings indicate Iowa teachers are progressing well with instructional technology integration. Iowa is ahead of the national average with most types of technology in the schools, including the ratio of students to computers. Teachers say they see computer technology as a tool to help them better accomplish their educational goals with students. They say technology changes both what they teach and how they teach.

The enthusiasm Iowa teachers have for learning is the biggest factor motivating them to integrate technology into the curriculum. Teachers say they enjoy

learning, and technology is an exciting new area for them to explore. Students are also enthusiastic about using technology as a tool to learn, and teachers say enthusiasm for technology translates into increased learning of content for students.

Teachers face some difficult barriers as they attempt to integrate computer technology into the curriculum, including inadequate training, inadequate access to technology, and lack of time to learn and use technology. These barriers seem to be faced by teachers everywhere, regardless of whether the teacher is at a high technology or low technology school.

Despite the barriers, there are changes occurring in teaching and learning because of computer technology in the classroom. Teachers say technology makes it possible for them to become a facilitator of learning rather than a lecturer. Both teachers and students say students are taking more responsibility for their own learning, and there are more opportunities for individualized and hands-on learning.

CHAPTER 1. INTRODUCTION

Background for the Study

Technology has transformed nearly every aspect of our personal and professional lives. Computers, video, television, radio, telephones, and telecommunications networks have a significant impact on how we live, work, and play. This is a time of incredible technological advancement, and computing power is more available and affordable than ever.

Many believe the recent revolutionary changes in instructional technology hold great promise for revolutionizing education (David, 1994). In fact, instructional technology is often considered an important tool for bringing about the kind of systemic changes called for in recent reform efforts across the nation (Means, Blando, Olson & Middleton, 1993). "When computers, e-mail, and other high-tech tools are used, many educators believe, students improve their thinking skills. Teachers change the way they run their classrooms. Parents become more involved. Assessments reflect real-world activities. Children enjoy learning" (Fatemi, 1998).

Significant progress has been made in the amount of computer technology going into our nation's schools in the past year. In 1997 there were 21 U.S. students for every instructional multimedia computer. By 1998 that statistic dropped to 13 students per instructional multimedia computer (Technology Counts, 1998). Technology can have positive benefits for students, but those benefits depend on how the technology is used (Wenglinsky, 1998). The benefits of technology seem to increase as the use of the technology becomes more sophisticated (Wenglinsky, 1998).

For students, the ability to use technology is an essential skill. According to the Secretary's Commission on Achieving Necessary Skills (SCANS), "Those unable to use [technology] face a lifetime of menial work" (SCANS, 1991, p.15).

How are educational technologies being used in the nation's classrooms? A 1997 nationwide study of the status of technology in schools provides this summary:

> At one end of the spectrum, computers are used to 'deliver' traditional instruction, e.g., software provides drill-and-practice in multiplication tables. In other instances, computers provide students with experience in technologies that adults use in many work situations—word processors for writing, data bases for collecting and analyzing information, and desk top publishing software for publishing. Computers are increasingly being used to provide students with opportunities to explore 'microworlds', enabling them to 'construct' new knowledge and learn basic skills in useful contexts. Finally, Internet connections allowing electronic mail, file transfer, conferencing, and access to remote expertise and information offer tantalizing promise to educators seeking to prepare students for the 21st century. (Coley, Cradler & Engel, 1997)

The White House has made educational technology a high visibility, high priority issue. In his 1996 State of the Union address, President Clinton called for connecting every classroom in America to the information superhighway with "computers and good software and well-trained teachers" (Clinton, 1996). The White House announced four educational technology goals: (1) All teachers in the nation will have the training and support they need to help students learn using computers and the information superhighway; (2) All teachers and students will have modern multimedia computers in their classrooms; (3) Every classroom will be connected to the information superhighway: and (4) Effective software and on-line learning resources will be an integral part of every school's curriculum.

Teachers, like many in society, can find themselves lost in the changing landscape of technology. Yet, they are a critical part of our society's technological future. "Making the connection between technology and teachers – helping the 2.8 million teachers in public and private kindergarten-through-twelfth-grade (K-12) schools effectively incorporate technology into the teaching and learning process – is one of the most important steps the nation can take to make the most of past and continuing investments in educational technology" (OTA, 1995, p.8).

Despite this, most teachers have not had the education or training to use technology effectively in their teaching (Coley, 1997; Drazdowski, 1990; Dupagne & Krendl, 1992; Office of Technology Assessment, 1995). Schools have made great strides in helping teachers use basic tools such as word processing and databases, but they still struggle to integrate technology into the curriculum. "Curriculum integration is central if technology is to become a truly effective educational resource, yet integration is a difficult, time-consuming, and resource-intensive endeavor" (Office of Technology Assessment, 1995, p.2).

Statement of the Problem

Until now, the statewide research on instructional technology in Iowa schools has been primarily in the form of numbers: statistics on the number of computers in the school, the number of pupils per computer, and the number of schools with access to the Internet. The Iowa Department of Education collected baseline data to "describe the status of Iowa public school technology, to reflect needs, and to facilitate the school improvement process" (Iowa Department of Education, 1997).

The statistics are helpful, but do not paint a complete picture of what is happening with technology in Iowa's schools. This qualitative study focuses on the people and the process involved in integrating computer technology in the schools rather than the hardware and software. This study is an effort to understand the role of the teacher in Iowa's schools as technological changes occur. It is important to know what motivates teachers to integrate computer technology into the curriculum, their perceptions concerning the barriers they face, and how they perceive instructional technology is changing teaching and learning. This formative information makes it possible to determine where additional support is needed as the technological landscape in our schools continues to change.

Research Questions

1. How do Iowa teachers define technology integration?
2. What motivates Iowa teachers to integrate technology into the curriculum?
3. What barriers do teachers face as they attempt to integrate technology into the curriculum?
4. How does technology enable Iowa teachers to change how and what they teach?

Significance of the Study

A study of how Iowa teachers are currently using and thinking about technology in the classroom is important for several reasons. It is clear that technology will increasingly become an important part of education (Office of Technology Assessment, 1995). Teachers are the most critical link in the process of integrating technology into the curriculum (Hadley & Sheingold, 1993).

An understanding of how teachers define technology integration provides important information about what teachers may see as the goal of their efforts in using computer technology in the classroom. Information on what motivates teachers to integrate technology is essential for advancing technology integration in our schools. An understanding of the barriers teachers face is critical before those barriers can be removed. Information on how technology changes teaching can help administrators, policy makers and funding sources make the types of decisions that can advance the goals of both students and teachers.

This study will look at the technology use of Iowa teachers within the framework of the Concerns Based Adoption Model (CBAM). This model proposes that adopters of innovations progress through a predictable sequence of concerns as they become more familiar with an innovation. This framework makes it possible to diagnose the level at which Iowa teachers are using computer technology, and provides a prescriptive model for a concerns based approach to facilitating change.

This is a formative study. The goal is to provide information and recommendations that will positively impact the process of technology integration in Iowa classrooms. Technology in education is changing at a rapid pace, and some schools are integrating computer technology into the curriculum at a much faster rate than others. Data gathered in this study can provide valuable information for policy makers and funding sources as they struggle to find the best approaches to school improvement in Iowa. Information of this nature is critical in order to provide teachers the needed resources and support. The Concerns Based Adoption Model is useful to diagnose the current level of technology usage and to determine how to help teachers increase computer technology integration.

This study may help set the tone for future research. It provides a wealth of information that will be valuable for framing questions for practitioners in the future, and provides information on specific areas where additional research is needed.

Definition of Terms

Innovation

In the Concerns-Based Adoption Model, the term “innovation” is used in a very broad sense. It refers to any idea, product or process that requires different behaviors of the user. In this study, the innovation is the use of technology in education.

Instructional Technology

In 1994, the Association for Educational Communications and Technology (AECT) defined instructional technology as "the theory and practice of design, development, utilization, management and evaluation of processes and resources for learning" (Seels & Richey, 1994). This definition of instructional technology will be used for the purposes of this study.

Integration

Integration of technology is defined broadly in this study. Because of the exploratory nature of this research, teachers were allowed to define integration for themselves. Many defined the integration of instructional technology into the curriculum as simply the use of technology in the classroom. Others applied a more stringent definition, considering technology to be integrated when it would be impossible to teach the class without technology. The majority of the teachers in this study discussed only the integration of computer technology. The full range of definitions will be considered technology integration for the purposes of this study.

Technology

Saettler (1990) defines technology as process rather than things such as hardware and software. In his most recent history of instructional technology, he defines technology as focusing on improvement of skills and organization of work rather than on tools and machinery. Saettler describes modern technology as systematized practical knowledge which improves productivity.

For the purposes of this study, technology is defined by the teachers involved in this research. They have defined technology primarily as things --- electronics-based items such as computers, calculators, cameras, videotape editing equipment, televisions and monitors, electronic sewing machines, and global positioning satellite technology. Other teachers define technology as more than things. They see technology as Saettler sees it, as practical knowledge that improves productivity. In this study, technology is defined broadly, as things, knowledge and processes.

Summary

This chapter provided an introduction to this study and a general overview of technology in education, with an emphasis on the role of teachers in technology integration. The study is an effort to understand the role of the teacher as technological changes occur in Iowa's schools. The information may make it possible to determine where additional support and resources are needed to continue technological advancements in the schools.

The next chapter reviews research related to this study including an overview of teachers and technology, barriers to technology integration, a look at Iowa's approach to technology integration, and an examination of the literature related to the Concerns Based Adoption Model (CBAM).

CHAPTER 2. REVIEW OF THE LITERATURE

Introduction

The possibilities for technology use in the classroom have grown at a phenomenal rate over the past decade, but the impact of technology on education has been surprisingly small (Gormly, 1996; Moersch, 1997; Zappone, 1991). Teachers face a number of significant barriers to integrating technology in their classrooms, yet many manage to successfully enhance teaching and learning with technology (Becker, 1994b; Bull et. al, 1997).

This chapter presents a review of research and key information related to four areas of importance to this study: an overview of teachers and technology integration; an examination of the major barriers to technology integration, including teacher training, access to technology, and resistance to technology; Iowa's approach to technology integration; and a discussion of the Concerns Based Adoption Model.

Teachers and Technology Integration

During the 1980s, a variety of new instructional technologies became increasingly available in schools, including television, videodisks, satellite technology, distance learning capabilities, and the computer. In 1987, there were 1.7 million computers in the schools. By 1994, the estimated number of computers in public schools more than tripled to 5.5 million, and 98% of all schools owned at least one computer (Mehlinger, 1996).

Despite these changes, education today looks much like it did decades ago (David, 1994). Although the number of computers in schools continues to increase, the overall change in teaching and learning has been minimal (Gormly, 1996; Moersch, 1997; Zappone, 1991).

The “expert” advice on what teachers should do with technology in the classroom has changed throughout the years, according to Becker (1994b) (Table 2.1). In 1982 teachers were told students should program in BASIC because “it’s the language that comes with your computer.” In 1984, experts told teachers LOGO programming could “teach students to think, not just program.” By 1986, experts suggested that teachers use integrated drill and practice systems to individualize instruction and increase test scores. In 1988 experts advised teachers to teach word processing skills so students could use computers as tools. By 1990, the prevailing wisdom was to teach with curriculum-specific tools such as history databases, science simulators, or data probes in an effort to integrate the computers with the existing curriculum. With the arrival of multimedia hypertext programming capabilities in 1992, the experts told teachers to “change the curriculum--students learn best by creating products for an audience.” And by 1994, the experts were advising that teachers “let students be part of the real world” by teaching with Internet telecommunications (Becker, 1994b).

Table 2.1. The “expert” advice on what teachers should do with technology, by year.

1982	BASIC
1984	LOGO
1986	Integrated Drill and Practice Systems
1988	Word Processing
1990	Curriculum-Specific Tools
1992	Product Production
1994	Internet Telecommunication

(Source: Becker, 1994b)

What Does Successful Technology Integration Look Like?

In a nationwide study of teachers who use technology, Hadley and Sheingold (1993) found that teachers who had truly integrated computer technology into the curriculum used computers as multipurpose tools. They were most likely to use the full range of software and computer-related technologies, from simple to more advanced. Word processing software was used most widely by the group of teachers studied, and the majority of those teachers asked students to create their own products using software tools.

Hadley and Sheingold also found that what teachers did with computers in their classrooms reflected how much experience they had:

> Initial practices and approaches tend to be similar to familiar well-structured classroom technologies (e.g., the workbook) more focused on reinforcing directly what is already being taught or, for particular groups of students, providing special opportunities. Those practices continue, but play a lesser role over time, as teachers become more expert and comfortable at integrating technology with teaching. Gradually, teachers are able to manage more expansive uses that differ from more familiar technologies, that afford self-generated learning opportunities for all students, and that may engender new approaches to the curriculum itself. (p.279)

For most teachers, it requires five to six years of teaching with computers to master the practices and approaches, and to build the foundation from which they can flexibly make choices about using new applications and using familiar applications differently (Hadley & Sheingold, 1993).

Becker (1994a) looked at how exemplary computer-using teachers differ from other teachers. Becker defined exemplary computer-using teachers as educational practitioners who engaged students in computer-based activities that involved higher order thinking. These activities included interpreting data, reasoning, writing, solving real-world problems, and conducting scientific investigations. Becker found that four factors in the teaching environment made exemplary computer using teachers more likely to be present: collegiality among users, school support for using computers for consequential activities, resources allocated to staff development and computer coordination, and acknowledgement by administration of the resource requirements for effectively using computers.

The most significant difference between exemplary and other computer-using teachers found by Becker is the total number of teachers at the school who used computers.

> If they are to successfully incorporate a new and complex resource like computer software into their teaching practice, they must have access to other people from whom they can learn, either experts who have already mastered the resource or a community of teacher-learners who pool their efforts and share their exemplary findings. (Becker, 1994a, p. 303)

Similarly, Marcinkiewicz (1996) found that an environment rich in technology integration is an important part of motivating teachers to use technology. In order for teachers to successfully adopt computers and integrate technology into the curriculum, there must be a perception that computer integration is expected. This is typically accomplished by an environment where administrators, colleagues, and students model the use of technology.

Becker (1994a) found exemplary teachers were twice as likely to be present at a school where students used word processing to complete assignments for three or more years. Exemplary computer-using teachers were also more often present at schools where computers were used to produce the school newspaper or the school yearbook. One of Becker's most consistent findings was that "exemplary teachers worked in school districts that had invested heavily in staff development and on-site staff support for computer-using teachers" (Becker, 1994a, p. 305).

Technology often has an impact on the teaching style of teachers. According to Pisapia (1994), teachers who adopt a technology-based approach usually "progress from presenter to coordinator of learning resources, thus freeing them to work individually with students. They move from being the 'sage on the stage' to the 'guide on the side'" (p. 3). Computer-using teachers find that technology facilitates an approach in which students are able to work on problems individually or in small groups, while the teacher circulates among them, helping students move from rote memorization to exploration and inquiry (Pisapia, 1994).

Integrating technology into the curriculum is a difficult task. What motivates teachers to expend the additional time and energy? In a national survey, teachers said the most important incentive for incorporating technology into their teaching is that computers become "a tool for children that works for them in their learning, such as writing, analyzing data or solving problems" (Hadley & Sheingold, 1993).

Barriers to Technology Integration

According to the International Society for Technology in Education (ISTE), the goal is for teachers to model computer use in the classroom and to naturally integrate technology in the curriculum in relevant ways that prepare students to face the challenges of the next century (Friske, et. al, 1995). Yet very few schools are doing a good job of helping teachers and students infuse computers into their daily lives (Office of Technology Assessment, 1995). "Curriculum integration is central if technology is to become a truly effective educational resource, yet integration is a difficult, time-consuming, and resource-intensive endeavor" (Office of Technology Assessment, 1995, p.2).

There are some significant roadblocks slowing the integration of technology in the classroom: lack of adequate teacher training (Coley, 1997; Dradowski, 1990; Dupagne & Krendl, 1993), lack of access to technology resources for teachers (Cummings, 1995; Ellmore, 1993), and resistance to technology (Marshall, 1995; Terrell, 1995; Wesley, 1996).

Teacher Training

Technology training for teachers remains an important part of the technology integration process. Teacher training issues often are a major roadblock to technology use in the classroom (Dradowski, 1990; Dupagne & Krendl, 1993;

Wetzel, 1997). The Congressional Office of Technology Assessment (OTA) recommends spending 30 percent of total project funds on staff development. According to the OTA, most school districts across the country allocate no more than 15 percent of their technology budgets for training and development (Office of Technology Assessment, 1995).

A survey of recent graduates of teacher education programs by the OTA found that while half had received training in the use of drill-and-practice and tutorial software, fewer than one in ten said they felt prepared to use formats such as multimedia packages, electronic presentations, network collaborations, or problem-solving software.

> The kind of technology training provided is as important to teachers as the availability of training. Some teachers observe that the content of training they receive is inadequate, there seems to be a focus on basic training in the mechanics of operating the machines, with little training about integrating the technology into various subjects or learning to use it as a pedagogical tool. (OTA, 1995, p.137)

Because educators have widely varying degrees of computer proficiency, it is critical the training be flexible and focus on meeting individual needs (Hirumi & Grau, 1996). It is also important that the training be process oriented. Teachers must develop the skills needed to address the rapid accumulation of information and constant advances in computer technology (Hirumi & Grau, 1996).

Sheingold and Hadley (1990) recommend that schools allow teachers to take computers home over the summer and on weekends. This approach encourages experimentation with technology, and helps teachers become comfortable with technology more quickly.

Teacher Access to Technology

Technology can be an incredible resource for teachers to use in the classroom. Before teachers can benefit from this rich resource, however, they must have access to the hardware and software.

Data about the access teachers have to technology in the classroom context is difficult to find. Becker (1994b) synthesized and analyzed a number of major national surveys of educational technology. Most of the available survey data included in the analysis came from principals or technology coordinators, and therefore the data tends to be focused on technology access and use at the building or district level rather than the classroom level.

Data on the amount of hardware present in schools is easy to obtain, but estimates on how frequently the hardware is being used and for what purposes is considerably more difficult. Results of a 1992 nationally representative survey of teachers illustrates the gap that often occurs between having access to technology and actually using it. Only 60 percent of the teachers who reported having personal computers "readily available" said they use that resource "regularly" (National Education Association, 1992).

According to the Office of Technology Assessment, a key factor that affects how teachers use computers is the location of the computers within the school building. Access to a computer lab allows the teacher to use computers with the entire class, but unless the teacher also has a computer in the classroom, it is difficult for the teacher to integrate computer technology with other learning activities throughout the day (OTA, 1995).

Sheingold and Hadley (1990) also see the location of technology as a significant barrier to integration. They recommend, if resources permit, that schools provide computer access in both labs and classrooms. Locating computers in the classroom is a growing trend according to Pisapia (1994). "The classroom location frees teachers to use them as needed. Labs, on the other hand, tend to be inaccessible and require scheduling" (p. 3).

Teacher Resistance

One roadblock for innovations such as technology in the classroom is teacher resistance (Marshall, 1995; Terrell, 1995; Wesley, 1996). In the past, the solution to teacher resistance was often increased training and development of teachers to support and encourage adoption. More recent research suggests that:

> teachers' adoption of technologies in the classroom involves more than the mere acquisition of necessary technical skills and information. In this perspective, technology adoption is seen to involve the alteration of often deeply held beliefs and values regarding teaching methods, education, and the proper roles of teachers and students. (Wesley, 1996, p. 2)

The philosophical changes that are necessary before technology adoption can occur, along with the continuous advancement of sophisticated computing and communication technologies available in the classroom, serve to significantly amplify the problems.

Marshall reports that often teacher resistance to technology integration is closely related to approaches that were unfamiliar to or in opposition to teachers' philosophies and practices. "The inherent tendency of institutions to perpetuate themselves in the 'way it's supposed to be' tradition was at odds with many of the innovations' demands for a different way of organizing schools and classrooms" (Marshall, 1995, p. 91). In addition, teachers have a tendency to "fight any organizational innovation that, in their perception, drains resources from activities that are traditional within the classroom" (Terrell, 1995).

Many teachers are resisting change because they have never seen an approach that integrates technology into the curriculum. According to Marshall (1995), there is a "dearth of visual models for how teaching with computers can be accomplished" (p. 91).

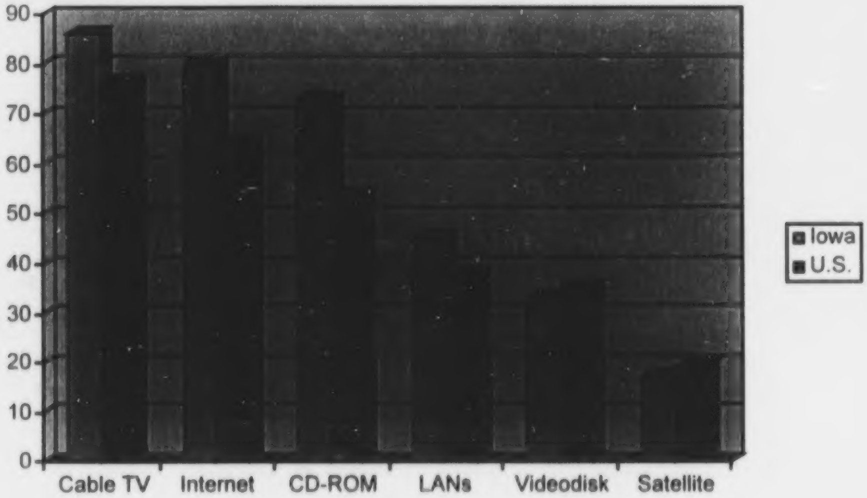
Iowa's Approach to Technology Integration

According to a 1997 nationwide study, Iowa tends to be above average in a number of areas related to educational technology. Coley (1997) reports Iowa ranks above the national average in percentage of schools with cable television, Internet access, CD-ROM, and local area networks. Iowa falls slightly below the national average in just two of the eight categories explored in this study, percentage of schools with videodisk players and percentage of schools with satellite technology

(Figure 2.1).

Figure 2.1. Percentage of schools with Internet, cable TV, satellite technology, CD-ROM, videodisk and local area networks (LANs): Comparison of Iowa and U.S. (Source: Coley, 1997)

Iowa's statistics are better than the national average when it comes to the number of students per computer, according to Coley (1997). Iowa has about eight (8.1) students per computer, while the national average is 10. When it comes to multimedia computers, Iowa has an average of nearly nineteen (19.3) students per computer, while the national average is nearly twenty-four (23.7) students per computer (Figure 2.2).



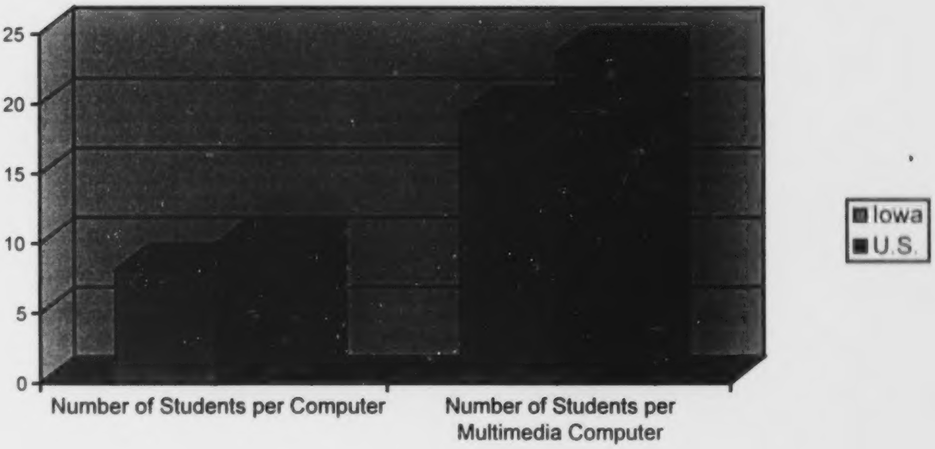


Figure 2.2. Number of students per computer and number of students per multimedia computer: Comparison of Iowa and U.S. (Source: Coley, 1997)

The Iowa Department of Education conducts an annual survey of technology in Iowa's schools, and reported statewide averages that differ from those reported by Coley (1997). The Iowa Department of Education report indicates a substantial decrease in the number of students per computer in Iowa during the three years tracked. In 1995-96 the statewide average for number of students per computer was 7.2, compared to 5.9 in 1996-97. By the 1997-98 school year, the average number of students per computer had improved to 5.2 (Table 2.2).

Table 2.2. Average number of students per computer in Iowa, 1995-1998.

School year	Average number of students per computer in Iowa
1995-1996	7.2
1996-1997	5.9
1997-1998	5.2

(Source: Iowa Department of Education, 1998)

Nearly half (49.8%) of the computer usage in Iowa public schools occurred in computer labs during the 1997-98 school year, according to the Iowa Department of Education (Figure 2.3). About 44 percent (44.8%) of computer use occurred in classrooms, and just over 10 percent (10.3%) of the usage took place in the school's media center.

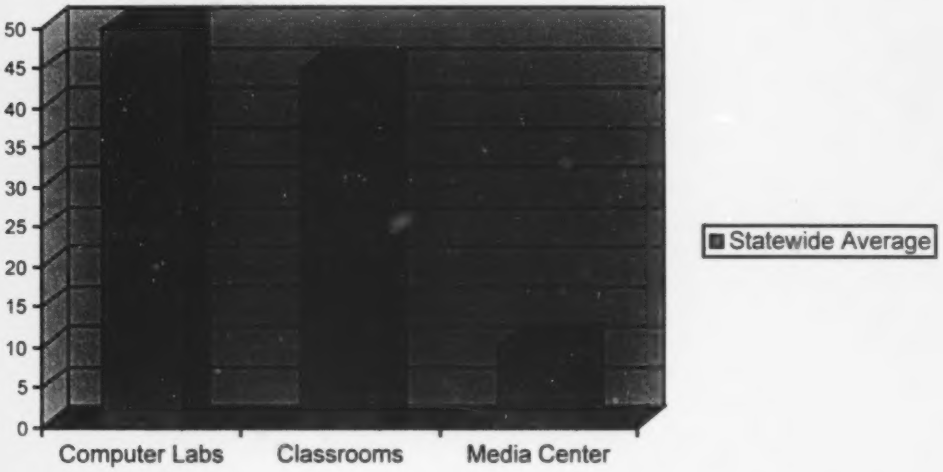


Figure 2.3. Average percent of in-school computers in Iowa public schools by location. (Source: Iowa Department of Education, 1998)

Iowa has a very decentralized approach to education. The philosophy behind this approach is that individual school districts are best equipped to determine what is best for the students they serve. "It is the single factor that explains Iowa's strong tradition of higher academic achievement. Communities in Iowa have historically set higher expectations than those that would have been established at the state level" (Hadley & Stilwell, 1998, p. 1).

While the decision-making power is firmly located in each of Iowa's 375 school districts, support for the districts comes from the state's fifteen Area Education Agencies (AEAs) (Figure 2.4).

> Quality and timely support for classroom instruction cannot be provided by a state agency alone. We are working in strong collaboration with each of Iowa's fifteen AEAs to help provide this support. For example, in the recent technology legislation that provides $30 million annually for school districts to improve instructional technology, the AEAs have a prominent leadership role in supporting the planning and staff development needs of school districts. The Department and representatives of each AEA are working closely together to meet that commitment. The support for school district technology planning is the first service to be put in place, but it must be followed by a statewide system of staff development in how to use technology to improve instruction. (Stilwill & Hadley, 1997)

AREA 12
AREA 10
ARE
16

Figure 2.4. Map of Iowa's Area Education Agency (AEA) regions.

The Iowa Legislature mandates in the School Improvement Technology Act that all local educational agencies (LEAs) file a technology plan with their AEA. The plans are expected to address the ways technology can be used to support the improvement of student learning. "Creating these plans will help the LEAs bring together all the components necessary for a successful learning experience, including technology, and show how all the components work together to benefit students" (Iowa Department of Education, 1998, p. 1). The technology planning framework suggested by the Iowa Department of Education includes four main components: identifying the intended results of applying technology to learning, implementing priorities and strategies, evaluating student achievement and the plan itself, and revising the plan.

The accreditation process for state teacher preparation programs requires the inclusion of a technology course. For in-service teachers, Iowa requires professional development in technology as part of the broader school improvement process. The state also provides some funding for staff development in technology.

Some of the staff development areas provided by Iowa public school districts during 1997-98 are displayed in Figure 2.5 (Iowa Department of Education, 1998). The most prevalent staff development areas overall were classroom technology applications and general computer use. These two areas tended to rate the highest across enrollment categories.

Concerns Based Adoption Model (CBAM)

The Concerns Based Adoption Model (CBAM) provides the conceptual framework for this study. This theory assumes change is a process that follows a seven-stage developmental sequence regarding the concerns that faculty have when an innovation is adopted (Hall & Hord, 1984). CBAM is based on the literature

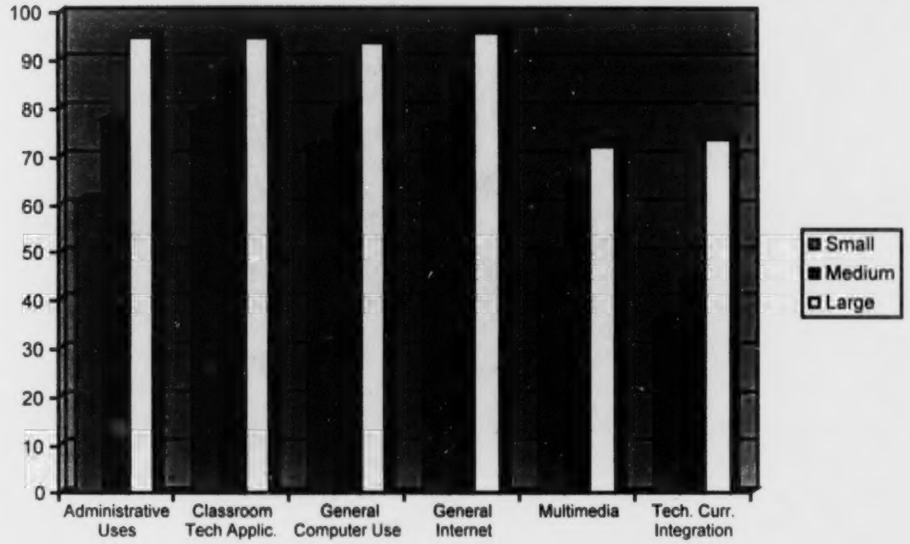


Figure 2.5. Percent of Iowa public school districts providing technology related staff development – 1997-1998. (Source: Iowa Department of Education, 1998)

of the educational change process. There is an enormous amount of data on change literature, and many models created to stimulate the planning of educational change.

CBAM is different from previous change models in that the individual is the unit of analysis, and CBAM looks at innovation adoption as a developmental process with measurable levels and stages (Hall, 1974b). This theory is based on Fuller's (1969) work about the developmental nature of teacher concerns. Fuller found that pre-service teachers tend to be focused on self concerns. Student teachers focus on managing the tasks of teaching. As teachers gain experience, they become more concerned about their impact on students. Hall and Hord (1987) found these three sequences of concern (self, task, and impact) were also present when experienced teachers were faced with the challenge of implementing an innovation in the classroom.

CBAM is a framework for examining the very complex process that occurs when educational institutions become involved in adopting innovations. CBAM was developed specifically to diagnose the needs of teachers and school leaders involved in the implementation of an innovation (Hall, 1974b). The model is based on the assumption that change is an ongoing, personal experience, and the change process is mediated by the extent that training is matched to the needs and concerns expressed by individual trainees (Hall & Loucks, 1978).

CBAM views the teacher as the focal point in school improvement efforts, yet acknowledges significant social and organizational influences as well. The model focuses on two facets of the individual's developmental growth in relation to the innovation. The first is Stages of Concern About the Innovation (SoC), which describes seven kinds of concerns that individuals experience at various times in the change process (Table 2.3). There are three basic areas of concerns: self (concerns about personal ability), task (concerns about the performance of the task), and other concerns (concerns about cooperation among colleagues, concerns about the impact of the innovation on others).

In the area of self-concerns, teachers tend to think about what the innovation will actually mean for themselves. Typical questions include: Can I manage this? Am I functioning well enough? I have just re-worked things. Do I have to make changes again? How much more does it demand of me and will I benefit from it at the end?

Table 2.3. Stages of concern (SoC): Typical expressions of concern about the innovation.

Stages of Concern	Expressions of Concern
0. Awareness	I am not concerned about it (the innovation).
I. Informational	I would like to know more about it.
II. Personal	How will using it affect me?
III. Management	I seem to be spending all my time getting material ready.
IV. Consequence	How is my use affecting kids?
V. Collaboration	I am concerned about relating what I am doing to what other instructors are doing.
VI. Refocusing	I have some ideas about something that would work even better.

(Source: Loucks & Hall, 1979, p. 4.)

Task concerns are related to the potential impact of the innovation on one's task. Typical questions include: Is the innovation efficient? Is the invested time proportionate to the required results? Typical problems include concerns about making the innovation work, and concerns about keeping up with rapid changes in the use of the innovation.

Next, attention is typically focused on others. This could include students, parents, or administrators. The emphasis is often on cooperation between colleagues. Typical problems include: It is always the same core group of people who participate in an innovation project. It can be very difficult to exchange ideas on the innovation with others. What more can teachers do as far as teamwork is concerned? Constructive criticism is not appreciated by my colleagues.

The second major dimension of the CBAM is Levels of Use of the Innovation (LoU), for which eight levels have been defined (Table 2.4). LoU describes how performance changes as the individual becomes more familiar with an innovation and more skillful in using it. The Levels of Use framework makes it possible to analyze the level at which teachers apply and use an innovation.

Users begin by seeking information about the innovation, then move toward mechanical use of the innovation, and routine use. At the higher levels, users integrate their use of the innovation by coordinating with others, then seek increasingly effective alternative uses for the innovation based on the needs of students.

Table 2.4. Levels of use (LoU) of the innovation: Typical behaviors.

Levels of Use	Behavioral Indices of Level
0. Nonuse	No action is being taken with respect to the innovation.
I. Orientation	The user is seeking out information about the innovation.
II. Preparation	The user is preparing to use the innovation.
III. Mechanical Use	The user is using the innovation in a poorly coordinated manner and is making user-oriented changes.
IVa. Routine	The user is making few or no changes and has an established pattern of use.
IVb. Refinement	The user is making changes to increase outcomes.
V. Integration	The user is making deliberate efforts to coordinate with others in using the innovation.
VI. Renewal	The user is seeking more effective alternatives to the established use of the innovation.

(Source: Loucks & Hall, 1979, p. 5.)

This model is helpful because levels of use and levels of concern change in predictable ways (Hall & Loucks, 1977). Generally, people begin at Level 0 Nonuse and develop through Level IVa Routine. Some will then move to any of the higher levels, while others will go back to Level III Mechanical, and others will remain at the Routine Level indefinitely.

If concerns do change predictably, in-service and other intervention activities can be designed or planned in advance. Hall and Hord (1987) explain the benefits:

> These interventions could be designed to address concerns as they emerge. For example, it should be possible, at least in general ways, to anticipate the concerns that will be intense at the beginning of a change effort. As the implementation phase arrives, certain other concerns will be likely to appear, and the needed interventions could be anticipated. Assuming the innovation is appropriate, a general picture of how all concerns are likely to evolve can be developed. (p.70)

According to Loucks and Hall (1979), implementing an innovation takes more than just one year. "From the CBAM perspective, an innovation cannot be said to be 'institutionalized' until teachers are at a routine Level of Use or above" (p.24). This diagnostic framework can be helpful to change facilitators in planning and guiding the change process as well as to monitor progress.

Loucks, Newlove, and Hall (1976) developed a focused interview procedure to measure levels of use. The use of the interview in research (telephone interview, one-on-one or focus group interview) is certainly not new or novel. Rutherford (1978) explains the value of the personal interview as a research tool:

> First, the individual is truly the key person in the change process and through an interview the personal perceptions of each individual can be secured. Secondly, the flexibility of the interview makes it possible to obtain both

> breadth and depth of information. Thirdly, by deciding in advance the information desired, the interview can produce the precise information needed for diagnosis and prescription. Finally, the interview is a very personal technique in a research world that is frequently very impersonal. (p. 3)

A series of longitudinal and cross sectional studies have verified the existence of seven Stages of Concern and eight Levels of Use (Loecks & Andrews, 1980). By applying the CBAM instruments, a diagnosis can be made of people's concerns related to innovations. The instruments can also be used in an evaluative manner to determine the progress that has been made in use and/or concerns.

Summary

This chapter provided a review of the research and key information related to four main areas of importance to this study. First, a review of the literature on the role of teachers in technology integration and an examination of the major barriers to technology integration that commonly appear in the literature. Next, a look at Iowa's approach to technology integration. And finally, the Concerns Based Adoption Model (CBAM) was discussed, with an emphasis on the Levels of Use of the Innovation framework and the Stages of Concern.

CHAPTER 3. METHODOLOGY

Introduction

The process of integrating computer technology into the curriculum in Iowa high schools has been underway for a number of years for some schools. Others are just beginning the process. In order to assist teachers with the integration process, detailed information is needed about what occurs in the classroom. The methodology used in this study is explained in this chapter. The participant selection process is described; next a description of site visit preparation activities, question development, an overview of the researcher training process, a description of data preparation and collection methods, an explanation of the limitations of the study, and finally, a summary of the chapter is provided.

This study was conducted as a part of the evaluation activities of the Iowa Distance Education Alliance, Iowa's Star Schools Project. This researcher's role, as one of three lead researchers, was to work in a team atmosphere to determine the specifics of the methodology and carry out the project. Support for data collection was provided by the US Department of Education Star Schools grant #R 203 F 500 1-97.

Selection of Participants

In Spring 1997, thirty public Iowa high schools (grades 9-12) were chosen to be included in this study, two from each of Iowa's fifteen Area Education Agency regions (Figure 3.1). The selections were based on three criteria: the ratio of pupils to computers in the district, school district size, and population density. A proportional stratified sampling approach ensured the selections were representative of the statewide statistics on these three criteria.

Figure 3.1. Iowa's Area Education Agency regions.

In order to determine the technology level of the school, the 1996-1997 statistics published by the Iowa Department of Education on the number of pupils per computer for each school district within each AEA were examined. In an effort to chose a "high computer technology" and "low computer technology" school from each AEA, the school with the largest number of pupils per computer and the school with the smallest number of pupils per computer within each AEA were initially chosen. The range varied considerably between AEAs (Table 3.1). The statewide range of the ratio of pupils per computer is 0.7 to 53.2.

Table 3.1. Range of pupils per computer for each of Iowa's Area Education Agency regions.

AEA Number	Lowest district ratio of pupils per computer in AEA	Highest district ratio of pupils per computer in AEA
1	3.3	12.7
2	2.8	18.3
3	1.5	7.1
4	3.6	7.4
5	3.2	17.5
6	3.7	53.2
7	0.7	12.9
9	3.2	9.1
10	3.6	11.4
11	2.7	20.1
12	2.4	12.8
13	1	15.3
14	2.2	9.7
15	3.1	8.6
16	3.9	9.1

Source: Iowa Department of Education, 1998

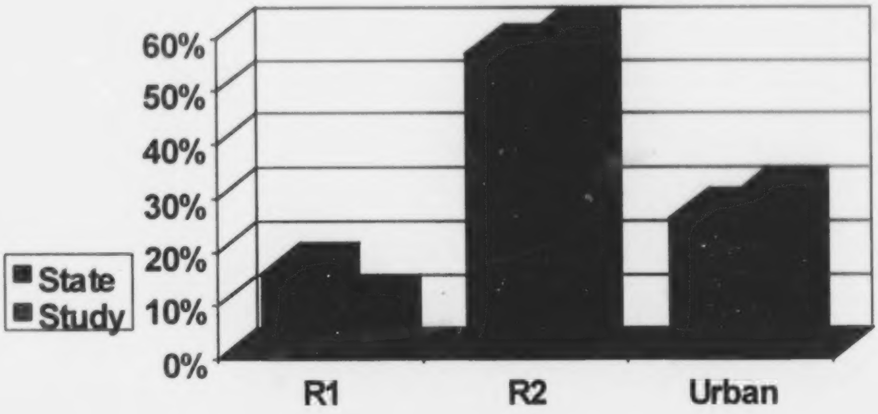


Figure 3.2. Population density: Comparison of state and study demographics.

Next, the schools selected in the first round were examined in conjunction with the statewide statistics on the remaining two criteria: population density (Figure 3.2) and district size (Figure 3.3).

Population density is determined by the number of people who live in the county where the school is located. A Rural 1 (R1) school is located in a county with a population of less than 2,500 people. A Rural 2 (R2) school is located in a county with a population between 2,500 and 19,999, and an Urban school is located in a county with a population greater than 20,000.

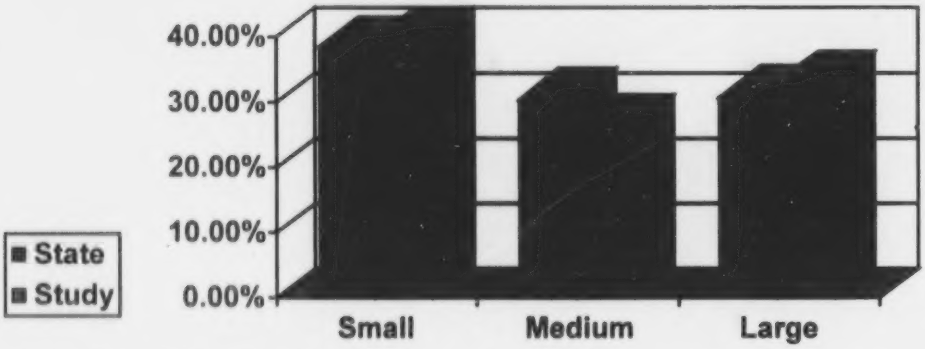


Figure 3.3. District Size: Comparison of state and study demographics.

District size is determined by district enrollment. For the purposes of this study, a small school is in a district with enrollment of fewer than 599 students. A medium-sized school is in a district with between 600 and 999 students, and a large school is in a district with more than 1000 students.

Every effort was made to ensure the selected schools were representative of the state as a whole in terms of population density and district size, and some adjustments to the original selections were made to bring the sample population closer in line with state demographics.

After the school districts were chosen for site visits, the high school principal was contacted to request permission for a team of two researchers to spend a day at the high school to collect data and meet with teachers, students, the technology coordinator, and the principal (See Appendix A for an outline of the planned phone information). Of the original 30 selected schools, 28 agreed to participate. Two additional schools were chosen to replace the two that declined to participate.

The principal at each participating school was asked to select a random group of eight teachers from a variety of content areas for a focus group to discuss the integration of technology in the curriculum. A date for the site visit was agreed upon, and the principal was sent a letter confirming the details of the visit (Appendix A). The week prior to the scheduled visit, the principal was contacted again by telephone to confirm the arrangements.

Preparing for the Site Visits

Because of the wide scope of this project, it was necessary to recruit additional researchers to conduct site visits. Thirty school visits were scheduled, and a visit to each of the state's 15 Area Education Agency region offices was also planned. One of the three main researchers would be on each visit, and assistant researchers would be needed to help with focus group interviews and observational research.

Research assistants were recruited from the Technology Research and Evaluation Group and the Center for Technology in Learning and Teaching in the College of Education at Iowa State•University. All researchers were graduate students or faculty members in the College of Education.

Training materials were prepared to ensure all researchers understood the objectives of the project. Researchers were provided with an overview of the project (Appendix B), research questions, and information on focus groups and observational research.

An information packet was created for each school that included the name, address, and phone number for the school, the principal's name, the agreed-upon schedule for the day, a map to the school, a print-out of the school's Web page, focus group questions, and observation information sheets (Appendix B).

Question Development

The development of the research questions and specific interview questions involved input from a number of interested parties. Initial questions were created, then reviewed by members of the Iowa Department of Education and Iowa Public Television. Their input was reflected in the revision of the questions. The most significant change that occurred due to suggestions from these outside organizations was the focus moved from gathering information on telecommunications usage in Iowa high schools to gathering more general information on computer technology use in the schools.

This project looked for the answers to three very general research questions:

- What is the current state of technology in Iowa schools?
- What is happening in the classroom?
- What has changed because of technology?

Teachers were asked eight scripted questions in the focus group sessions:

- How do you use technology – both at school and at home?
- What does “integration of technology into the curriculum” mean to you?
- What motivates you to integrate technology into the curriculum?
    - Technology plan?
    - Staff development?
    - Colleagues?
    - Administrators
- What are the major barriers to technology integration?
- Where do you go for information about technology integration?
- How will technology enable teachers to change how and what they teach?
- How will technology enable students to change how and what they learn?
- Look down the road five to ten years. What role do you envision technology playing in teaching and learning?

Training the Researchers

There were ten assistant researchers involved in gathering data for this project. Most site visits included a main researcher and an assistant researcher. Some site visits were made by two of the main researchers. All researchers attended one of two training sessions to discuss the goals of the data gathering visits and to review focus group and interview procedures. The training sessions focused on note-taking, focus group procedures and the gathering of observational data during the school walk-through.

One part of the role of the assistant researchers during the site visits was to serve as the recorder for the focus group sessions. This entailed taking very detailed hand-written notes as a back-up to the audio tape recorder during the focus group interviews. Researchers were provided with a written description of focus group interview procedures (Appendix B), suggestions on how to record the pertinent information, and a list of information to record for each participant.

Data Collection

The researcher training took place during the first week in March, 1998. Site visits were scheduled to begin the following week but were delayed due to adverse weather conditions. The first set of site visits took place during the third week in March.

Two methods of data collection were used for this study. Site visits were used to collect qualitative data related to the research questions and documents were reviewed to provide additional evidence of the level of technology integration at the school.

Site visits were made to thirty public high schools in Iowa, two schools in each of Iowa's fifteen Area Education Agencies (AEAs). Each site visit included an interview with the school principal, a walk through the school with the technology coordinator (where available) to look at the technology in the classrooms and labs, a focus group session with about eight students, and a focus group session with about eight teachers. This research focused on the role of the teachers, although their comments will be considered within the context of the responses of the others at the school.

The teacher focus groups were planned discussions to obtain participants' perceptions about the integration of technology into the curriculum. At the beginning of each focus group discussion, certain procedures were established. Participants were assured their comments would be confidential. Participants were encouraged to interact with and respond to others in the group. The acceptance of differing points of view and both positive and negative comments was stressed. There were four ground rules that were communicated to the participants to help ensure that everyone was able to participate. Those four ground rules were: only one person speaks at a time, no side conversations, everyone participates and no one dominates, and all responses are equally valued.

Open-ended questions were used to allow participants the opportunity to comment, explain, and to share experiences and attitudes.

Immediately following each site visit, the researcher and assistant researcher debriefed in an effort to capture impressions as well as contrast findings with previous site visits. This reinforced and clarified observations and recorded responses.

At the end of the first week of data collection, lead researchers gathered to discuss how things went, and some minor adjustments to the data gathering process were made. Changes included a re-formatting of the observational data sheets for the school walk-through (Appendix B) and the rescheduling of some school visits to allow the researchers more time on site.

Each Friday during the three months that data was gathered, the three main researchers met to discuss how things were going during the site visits, and to share concerns and insights.

Data Preparation and Data Analysis

Because of the qualitative design of this study, the data analysis came primarily from the transcripts of the focus groups conducted with groups of teachers at the 30 schools included in the study.

In order to verify the perceptions of the teachers as reported in the focus group sessions, the data gathered at each school (the principal interview, the focus group discussions with students and teachers at the school, the technology coordinator interview, observational data, and the district technology plan) were used to write a case study for each site visited. (See Appendix C for case study reports). The case studies were written primarily by the lead researcher for each site, but the assistant researcher reviewed the case study draft and provided input and clarification. This member checking process allowed for review, verification and comment. Conclusions were revised and clarified based on recommendations from the member-checking process. The triangulation of a variety of sources of data helps to pinpoint the accuracy of conclusions. It also helps prevent the researcher from accepting the validity of his or her initial impressions without further substantiation.

The researcher necessarily has biases. Triangulation assists in correcting these biases, since the additional forms of data may be inconsistent with the initial beliefs of the researcher (Creswell, 1998).

After the individual case studies were written for each school, the transcribed text of all 30 teacher focus group sessions were formatted for a computer software package for qualitative research called Non-numerical Unstructured Data * Indexing Searching and Theorizing – or NUD*IST. The software allows for efficient management of the large amount of data collected for this research project, detailed exploration of the data, and the ability to explore patterns in the data.

The transcribed text of the teacher focus group sessions was coded by two researchers. Each researcher coded data into a core group of agreed upon categories, and each researcher was allowed to create new categories as needed (See Appendix D for a complete list of coding categories).

The original categories were determined by the three main researchers as they discussed the key themes they expected to find and the organization of information that would be helpful to the study. The first categories created were demographic in nature, including a variety of school characteristics (such as large, medium, small; high technology or low technology) and individual characteristics (job title, gender, computer at home). Next, coding categories were created for the themes found in the individual school case studies, such as vision, access, innovative uses of technology, impact of technology, and barriers. There was also a coding category created for each of the scripted focus group and interview questions. After all documents had been coded, the researchers discussed and justified additions. Some coding categories were combined at this point.

When the coding phase of the research was completed, researchers checked inter-coder reliability to look for potential coding problems. Four key categories with subcategories were chosen to test reliability. The categories were chosen because they were central to answering research questions (Table 3.2).

Each researcher numbered all the text units coded to each of the four main categories. A computer-generated list of random numbers was used to randomly select a sample of text units. Categories containing three sub-categories had three randomly selected text units chosen from within the category, while categories containing four subcategories were assigned four randomly selected text units. Each researcher then looked at the selected text units from the other researcher and coded them. Results were compared. There was complete agreement (100%) in three of the four categories (Table 3.3). The vision category had an inter-coder reliability of 25%. The original four subcategories were not discrete, and therefore it was difficult to place some text units in only one category. The categories were

Table 3.2. Coding categories examined for inter-coder reliability.

Category	Sub-Category
Vision	Lack of Vision
	Limited Vision
	Well-Defined Vision
	Innovative Vision
Access	No Access
	Limited Access

	Adequate Access
Innovative Uses	Innovative Classroom
	Innovative Partnership
	Innovative Project
	Innovative Use Outside Classroom
Impact	Positive Impact
	Negative Impact
	Unanticipated Impact

Table 3.3. Results of inter-coder reliability test.

Category	**Percent Agreement**
Vision	25%
Innovative Uses	100%
Impact	100%
Access	100%

collapsed to make them discrete, resulting in two categories: lack of/limited vision and innovative/well-defined vision.

Applying the Concerns Based Adoption Model (CBAM)

Determining the Teachers' Levels of Use

Hall's "Levels of Use of the Innovation" (LoU) framework was used to determine where the participating Iowa teachers fit into the innovation adoption continuum. The LoU interview instrument was developed to place individuals using an educational innovation into the LoU framework. The LoU instrument was examined, and found to be very similar in content to the focus group questions used with the teachers in this study (Table 3.4).

To confirm the validity of the instrument under the circumstances of this study, three researchers who assisted in teacher focus groups reviewed the LoU interview questions and the teacher focus group questions to verify the content similarities between the two. Each of the three researchers was given a list of the LoU interview questions in chart form, and a list of the teacher focus group questions. The researchers were asked to match the content of the focus group questions to the LoU interview questions.

Researchers were told the focus group questions could be put in more than one category, or in no category at all. The three researchers agreed the same information could be gathered with each set of questions. There were two LoU

Table 3.4. Comparison of LoU Instrument questions and Iowa Teacher Focus Group Questions.

LoU Instrument Question	Iowa Teacher Focus Group Question
Please describe for me how you use ___.	Briefly describe how you use technology both at school and at home. (Give examples)

What do you see as the strengths and Weaknesses of ___ in your situation?	What motivates you to integrate technology into the curriculum? What are the barriers to integration?
Are you currently looking for any Information about ___? What kind? For what purposes?	Where do you go to get information about integration of technology into the curriculum?
Do you work with others in your use of ___? Do you meet on a regular basis? Have you made any changes in your use of ___ based on this coordination?	What role do colleagues or administrators play in your motivation to integrate technology into the curriculum?
Do you ever talk with others about ___? What do you tell them?	What role do colleagues or administrators play in your motivation to integrate technology into the curriculum?
Are you doing any evaluation, either formally or informally, that would affect your use of ___? Have you received any feedback from students that would affect the way you're using ___? What have you done with the information?	(No directly related question)
Have you made any changes recently in how you use ___? What? Why? How recently? Are you considering making any changes?	How does technology enable teachers to change how and what they teach? How does technology enable students to change how and what they learn?
As you look ahead to later this year, what plans do you have in relation to your use of ___?	Look down the road five to ten years. What role do you envision technology playing in teaching and learning?
Are you considering or planning to Make major modifications or replace ___ at this time?	(No directly related question)

interview questions that did not have a direct match in the teacher focus group question set (Table 3.4).

The Level of Use framework will be used to determine where the schools in this study are located on the continuum. This determination will be made using teacher comments from focus group interviews conducted at each school. The unit of analysis for this process is the school, using the comments of the teachers along with information from students, the technology coordinator, the principal and the technology plan. The data from individuals at each school will be considered as a whole (See case study reports in Appendix C) to describe the Level of Use of technology for the school.

Determining the Teachers' Stages of Concern

A similar process was used to determine the Stages of Concern for teachers. Their comments were considered in the context of Loucks and Hall's "Expressions of Concern" in order to describe where teachers were on the Stages of Concern continuum (Table 3.5). Comments from teachers were considered along with data gathered from other sources at each school to determine an appropriate Stage of Concern for each school.

Hall and Hord (1987) describe three different techniques that can be used to determine stages of concern. The first is the "one-legged conference," an informal brief conversation between a change agent and a teacher. The second is the open-ended question, typically a teacher's written response to a question, such as "When

Table 3.5. Stages of concern (SoC): Typical expressions of concern about the innovation.

Stages of Concern	Expressions of Concern
0. Awareness	I am not concerned about it (the innovation).
I. Informational	I would like to know more about it.

II. Personal	How will using it affect me?
III. Management	I seem to be spending all my time getting material ready.
IV. Consequence	How is my use affecting kids?
V. Collaboration	I am concerned about relating what I am doing to what other instructors are doing.
VI. Refocusing	I have some ideas about something that would work even better.

Source: Loucks & Hall, 1979, p. 4.

you think about technology in education, what are you concerned about?". The third approach is the Stages of Concern Questionnaire, a 35-item survey with a seven-point Likert scale for each question. Each of the three procedure rates differently in reliability, validity and ease of use. The approach used in this study is most similar to the open-ended question technique. The Stage of Concern for the schools included in this study was determined by comments made by teachers during focus group interviews, and considered in the context of other data gathered at the school. The SoC framework is used in a descriptive rather than diagnostic manner.

Limitations of the Study

Two schools were chosen within each AEA for this study. One is called a "high technology school," and the other is called a "low technology school." It is important to realize that these designations are based on the pupil to computer ratios within each Area Education Agency region. The variance in the range of these ratios was extreme (.07 pupils per computer to 53.2 pupils per computer) (See Table

3.1). The computer ratio statistic is based on a very narrow definition of what technology is, and is therefore a limitation of this study.

The principal at each school visited was asked to select a random group of students and teachers for the focus group sessions. The students selected to participate were a sample of convenience. There is evidence that in many schools teachers were selected because of their use of technology. This purposive sample of teachers is skewed toward technology-users.

This study was done with a small sample of Iowa high school teachers. The results are not generalizable to any other population or any other state.

The Concerns Based Adoption Model is based on two well-tested instruments, the Levels of Use instrument, and the Stages of Concern instrument. The Levels of Use instrument is a focused interview, with questions very similar in content to the questions used in the teacher focus group interviews. The Stages of Concern open-ended approach to assessing concerns was also used in this study. The transcripts of comments made by teachers in focus group interviews were used to determine the appropriate Levels of Use and Stages of Concern for each school. The placement of each school on the Stages of Concern or Levels of Use continuum was determined by the category in which the majority of the teacher comments fit. It is important to remember that, in some cases, the comments from fewer than ten teachers at each school were used to help determine the school's placement.

It is also important to note this study was part of a larger study. Some critical decisions concerning the study were made by others, making it impossible for this researcher to control all aspects of the design and execution of this research.

Summary

This chapter provided an overview of the methodology for this study. The sample consisted of 194 teachers from 30 public high schools in Iowa. The schools in the study were chosen with a proportional stratified sampling approach to ensure the included schools were representative of public schools statewide.

Focus group interviews with teachers were the primary source of data for this study, but a variety of other data sources were used to verify and triangulate the data.

The Concerns Based Adoption Model (CBAM) (Hall, 1974b) was used to determine the current level of innovation adoption and stages of concern among participating Iowa high school teachers. Results obtained from the use of the focus group interviews are presented in the following chapter.

CHAPTER 4. RESULTS

Introduction

This formative study was conducted in an effort to gather descriptive data about Iowa high school teachers and their role in computer technology integration. Results indicate that most teachers, despite the technology level of their schools, are using computer technology in very basic ways. Teachers face a number of barriers to technology integration, including inadequate technology training, inadequate access to computer technology, and lack of vision and leadership. Despite the challenges, many teachers are using technology, and the integration of technology into the curriculum is triggering some important changes in the classroom.

This chapter begins with a description of the study participants, including an overview of how teachers say they use technology in the classroom. Next, the answers to the four research questions for this study, often in the words of the teachers themselves. This chapter will conclude with a summary of the results of this study.

Description of Participants

The data collected through focus group sessions with teachers at thirty Iowa schools were used to generate some basic descriptive statistics about the sample. The data describe participants' gender and curriculum area, and provide information about which teachers have a computer at home and which have Internet access at home.

Of the 194 teachers who participated in focus group sessions, 47.2% were male and 52.8% were female. The principal from each school was asked to select a random group of about eight teachers for a focus group. In most schools the principal invited a randomly selected group as requested. In a few schools, however, it was clear that the participants were the technology-using teachers. Table 4.1 displays the subject areas of the teachers who participated in the study. A total of twenty-one different subject areas were reported by participating teachers. The majority of the 194 teachers who joined the focus group discussions were from math, business, sciences, vocational technology, and English.

Table 4.1. Most frequently reported subject areas of participants.

Subject Area	Frequency	Percent
Math	22	11.3
Business	21	10.8
Sciences	21	10.8
Vocational Technology	19	9.8
English	18	9.3
Resource	15	7.7
Library / Media Specialist	14	7.2
Family & Consumer Sciences	9	4.6
Social Studies	6	3.1
History	6	3.1
Art	6	3.1
Music	6	3.1
Spanish	5	2.6
Guidance	5	2.6
Other	10	5.0
Missing Data	11	5.7
Total	194	99.9%

Eighty percent of the teachers in the sample said they have a computer at home. Fifty-three percent of the teachers said their home computer was connected to the Internet. The percentage of teachers in this study with home computers and Internet connections is higher than the national average. According to a 1998 study by market research company Computer Intelligence, about 50% of all U.S. homes have a personal computer, and about 27% of the nation's homes are connected to the Internet.

How do Most Teachers use Technology in the Classroom?

When teachers were asked how they use technology, typically they discussed basic applications, such as word processing and Internet research. Vocational technology applications and multimedia applications were more commonly found in high technology schools.

The most basic technology application of word processing was present in nearly every school visited as part of this research project. Word processing is appropriate for nearly every curriculum area and is the easiest way to begin to use technology in the classroom. Most teachers have incorporated this element.

The use of the Internet was the second most common application encountered in the schools included in this research. The Internet, like word processing, can be used in many different curriculum areas, and is easy to integrate into the curriculum.

Vocational applications are the third most common uses of technology found in the schools visited. Vocational applications are curriculum areas that tend to prepare students for work directly after high school, such as vocational technology, vocational agriculture, and family and consumer sciences. These areas tended to have more up-to-date technology than the rest of the school due to specialized funding sources, such as Carl Perkins funds. Teachers in these areas often appeared to be among the technology leaders in the schools visited.

Students and teachers are increasingly using multimedia applications for presentations and projects. Teachers are integrating interactive curriculum-based software programs where possible (Finale, Electronic Workbench, textbook companion CDs, etc.). The use of technology for the school newspaper, video newscasts, and yearbook was also mentioned in a number of schools.

Research Question One:
How do Iowa Teachers Define Technology Integration?

The first question in each of the teacher focus group sessions was "What does the integration of technology into the curriculum mean to you?" The responses were wide-ranging, but there were some patterns.

Technology as a Tool

The majority of the teachers responded by talking about the use of technology as a tool. "I think integration is probably the use of computers and technology to just further education. Not to replace teachers, but to help with some of the things that they do." Another teacher said: "I see the technology in our curriculum as a tool to do the things that we would have maybe attempted to do some other way or it's going to allow us to do more than we could have originally." Some teachers say integration of technology simply means using technology regularly in the classroom:

> I just say using it as a regular part, like another tool. Instead of just lecturing, you can do group work, watch movies, work on CD-ROMs, or do these drills on the computer, whatever it happens to be, but it's not something that we do just once in a huge while, it's something that becomes normal. But we have a ways to go. At least I have a ways to go.

Teachers also frequently talked about using technology as a display and presentation tool. A number of teachers discussed the use of presentation software as an alternative to a lecture approach in the classroom:

> They don't like to come into history class and sit and have me drone on. And so a couple of weeks ago, I brought it (the computer) in and I just took the notes and put them up on my monitor. And I had people actually taking notes, they were watching the monitor instead of just listening to me but they were getting more out of the class.
>
> If I were to integrate I would bring technology in to allow me to do something that is difficult to do otherwise. I had a student give us a video camera that you put on a microscope. To integrate that would allow me to teach the abstract. You say something is there (under the microscope), but they don't see it. Well, if you have a screen there, you can point to what you want them to see.

Others see technology integration as using technology to allow students to personalize learning and more clearly express what they have learned:

> One thing I did last year for the chemistry class, they each chose one of the lessons that we could cover that semester, and they did a Hyperstudio stack.

> They presented it to the class and then the kids went through that to review for their final.

Other Responses

Another common response to the question "What does 'integration of technology into the curriculum mean to you,'" was the use of technology in all curriculum areas. "It just means to me having the students get their hands on technology somehow. I think every curriculum should have a little bit of technology integrated into it." A number of teachers described technology integration as using technology to integrate curricular areas. "Integration includes content from other areas into yours. That is good." "It's very easy to go across the curriculum in industrial technology because there isn't a day that goes by that some sort of mathematics doesn't come up. Like today they were figuring scale ratios for their drawings".

Technology integration can also be a key component for connecting school work with the real world. One vocational technology teacher, like many others, said technology integration is critical for his curriculum area. "I use technology throughout to make a connection to other industrial arts classes, like the real-life applications."

Differences Between Low Technology and High Technology Schools

There was one very obvious difference in how teachers in high technology schools and teachers in low technology schools responded to this question.

Frequently teachers in low technology schools did not answer this question. Instead they talked about why they do not integrate technology into the curriculum:

> You've got lots of other things to do, so putting (technology) into the daily routine as a teaching tool is hard to do, especially in a small school. You have a large number of classes to try to change your curriculum and the way you teach it. Is it really going to give me anything more out of it for the kids?
>
> I don't see integration as possible unless I can be there with the students to help them. I can't be in two places at once, so I can't send them down to a lab and still be with the rest of the students in the classroom. I think it's kind of a catch-22 situation. But I would like to have more computers in my room.

Research Question Two:
What Motivates Iowa Teachers to Integrate Technology into the Curriculum?

Teachers mention a number of factors when asked what motivates them to integrate technology into the curriculum. The most commonly reported reason teachers have to integrate technology is their personal enthusiasm for learning. Teachers also integrate technology because it increases the enthusiasm students have for learning, and because they know how important technology skills will be for students after high school. Other motivators include the district technology plan, the encouragement of administrators, and colleagues.

Enthusiasm for Learning

The most frequently mentioned motivation for technology integration is the teachers' enthusiasm for learning and using technology. "I think it's really interesting. I think it's really fun. I enjoy my job. I enjoy researching, going to different seminars and learning more about newer technologies and different things I might be able to get in the future and teach my students." Other teachers say they are motivated to use technology because of the convenience. "It saves time." "You can do things with the technology, you can demonstrate things that you wouldn't do by hand because of time." Another teacher talks about her enthusiasm and the impact on students: "The more enthusiastic I become as a teacher, the more enthusiastic my students become as learners."

Some teachers are motivated by the realization that technology skills are necessary if they hope to continue working as a teacher:

> I think another motivation, too, if you are going to be a teacher that is kept around, you've got to go with technology. You'll become obsolete if you don't. And I guess that's all I look at. I think it's more of an insurance card.

The Student's Enthusiasm for Learning with Technology

The enthusiasm that teachers see in students when technology is used in the classroom is another very good reason to integrate technology, according to teachers. "They (students) think they're getting excited about learning how to use the technology. In the long run they're really getting excited about content area through using the technology." Teachers see technology as a way to reach students who might lose interest in learning otherwise. "We're seeing people asking to go to the library to get research. They're not people that normally would go to the library. That's because they see technology as part of it."

Preparing Students for the Future

Teachers say preparing students for the future--for college and for the workforce--is one of the best motivations for using technology in the classroom. "Your students need this, and it's important for them to be as advanced as other students coming out of other schools. So that's what motivates me. I don't want our students falling behind in any way, shape, or form." An art teacher says, "I want to prepare my students for the visual arts world… They have to have some background in computer graphics."

Technology Plan

Some teachers say the district technology plan is a motivating force for the use of technology in the classroom. "Because of the technology plan, they [teachers] had the computers available. They each had a computer in their classroom." One teacher says there is an Internet connection in his art room because of the technology plan, and that is why he uses it:

> I think the availability of the Internet in the art room is the reason we are using it. But if it wasn't there, I wouldn't be complaining about not having it. But since it is there, I've had my upper level art students do some research.

Administration

In some schools, administrators play an important role in motivating teachers to integrate technology. "Five years ago I said the art curriculum was in the 1890's. In the last five years we've gone leaps and bounds. Their [administration's] commitment made me decide I'd better learn it [technology]." Other teachers are more direct: "The reason we use technology is because our board expects us to."

Colleagues

In a few high technology schools, the importance of colleagues for motivating teachers to integrate technology became clear:

> You see a colleague doing something and it looks like a better way of doing something that you've done in the past, or if they're excited about a project that they're doing with their students because of the technology. Excitement breeds excitement, and that breeds interest.
>
> I think our staff works really well with one another. If you find a way that's quick to do something, or it's better to do something, you're very willing to share it.... 'I learned how to use this. Do you want to learn how to use it and how to incorporate it into a class?' It's made a big difference. We're not teaching in isolated rooms any more. I think we're doing more sharing back and forth. I think the technology is the reason we are doing that.

Differences in Motivation Factors Between High and Low Technology Schools

There were some interesting differences between how teachers at high technology schools and low technology schools responded to this question. Most of the teachers at low technology schools simply did not answer the question. Their response was often a list of reasons why they are not motivated to integrate technology. They discussed many of the barriers that are reviewed in the next research question. When teachers at low technology schools did address this question, they most often mentioned their enthusiasm for learning how to use and integrate technology as an important motivator.

Teachers at high technology schools were much more likely than teachers at low technology schools to mention colleagues as a motivator for integration. They were also more likely to mention student curiosity and enthusiasm as a motivating force.

Research Question Three: What Barriers do Teachers Face as They Attempt to Integrate Technology into the Curriculum?

There are several critical barriers to technology integration for teachers, including inadequate technology training, inadequate access to technology, lack of time for teachers to learn technology and use it in the classroom, and lack of vision by school leaders.

Technology Training for Teachers

Technology training for teachers is the area teachers see as the most significant barrier to successful technology use in the classroom. Many teachers feel they lack the skills needed to use technology in the classroom. They need to understand not only how to use technology, but how to integrate the technology into the curriculum. The training needs to be timely, and teachers need help making the time for technology training:

> We're either self-taught or not taught. I think there's a lot of material here in our school. We are told about all the programs we have. The Astound program, for example, is something I would love to learn, but I don't know enough about it to learn it on my own, and we don't have inservices for those sorts of things.

Access to Technology

There were a number of important access barriers mentioned by teachers, including: access to a computer in the classroom for teachers, access to a lab during the class period it is needed, access to a lab large enough to accommodate all students, and access to technology peripherals such as display equipment, probes and sensors, and appropriate software. Teachers said they found access barriers to be very frustrating, and one of the biggest reasons why they did not integrate more technology into the curriculum:

> It's very exciting for me to see what's out there in terms of computer technology, but it's kind of like taking a starving person to a Mister Donut, and letting them put their faces up to the window and say, look at what you can eat, but you can't have any.
>
> Having a computer on your desk makes a big difference. For example, the other day they said there was an important memo that went out on e-mail and wondered why I didn't get it. Well, I don't have a computer on my desk. So what the heck. Tie a note around a rock and throw it at my head. I'd have a better chance of getting it.

Time for Technology

Teachers are very concerned about the lack of time for technology. They say they need more time to learn computer basics, time to attend technology training sessions, time to figure out how to integrate technology in the classroom, and time in the classroom to use technology:

> It's not just the computer, you've got lots of other things to do. It's hard to integrate technology, especially in a small school, when you have a large number of classes and you try to change your curriculum and the way you teach it.

Vision

A critical component of successful technology integration is a vision for technology use (Marshall, 1995). It very quickly became apparent that in schools where technology was successfully being integrated there was a vision holder who could clearly articulate the expectations for technology use. In many schools the vision holder was the principal, but in some schools it was a group of teachers. The position of the vision holder was not as important as the ability of the vision holder to communicate the expectations of technology use to teachers, students, and administrators. Teachers realize how challenging it can be to move toward technology integration in a school that lacks a vision holder:

> You need to know the basics. How can you act as a spring board to something else because I don't even know what dreams are possible at this point. You know I would love to try other things, but I feel so ignorant of technology now -- both what we have and what the possibilities are.

In most schools, the document that holds the district's technology vision is the technology plan. This plan is required for every school district in the state in order to receive state technology funds. The technology plan is usually created by a technology committee, typically updated annually, and describes a five-year plan for acquisition and utilization of technology and technology training in the district.

Generally, teachers in low technology schools were less aware of the contents of their district's technology plan than teachers at high technology schools. “I know little or nothing about what's in the tech plan. I can't see that we have anything to show for the technology money we have spent.” “We have a tech plan, but nobody but me in here knows it.” “The tech plan is a secret. All input from the staff is ignored. We are promised money, then a new plan emerges and it's not what the teachers were told.”

A well-written technology plan that is articulated to the faculty can be an important part of moving toward improved technology integration:

> I guess the technology plan got us some computers, got us a plan as far as inservices, to what things we might want to try and teach, gradebook and then the spreadsheet, you know. We are really early into the whole plan in general.

Teachers at high technology schools are more likely to acknowledge the positive impact their district's technology plan has had in terms of allowing them to integrate technology into the curriculum. "It does play a role for me because it allows me to do some of those things when a technology plan is in place. I think because of the technology plan my curriculum has changed." "If we didn't have a good technology plan that made [computers] available for me then I couldn't [integrate technology]."

Other teachers discussed the positive impact of increased technology training for teachers because of the technology plan. "The technology plan has forced us to take staff development. All Phase III staff development has been earmarked for technology. We keep trying to meet the goals, to infuse technology. The pressure is on, but we are rewarded."

How do Barriers Differ for High Technology and Low Technology Schools?

There are some differences between teachers at high technology schools and teachers at low technology schools in the barriers they say they face.

Teachers from low technology schools expressed considerably more concerns about training than did teachers from high technology schools. Teachers in high technology schools did express concerns about inadequate inservice training. Some mentioned frustrations with "one-size-fits-all" training, training that was required but not relevant to their needs, training that was not hands-on, and training that was not timely. Teachers from low technology schools expressed the same concerns in this area, but had a number of additional concerns related to training.

The most frequent concern mentioned by teachers in low technology schools concerning training was that there simply wasn't enough of it. Teachers were frustrated by the expectation that they learn technology skills and applications on their own by "reading the book". Teachers were also frustrated by the lack of access to the technology. They say they often receive in-service training for a technology application, but do not have access to the application after the training is complete.

There are surprisingly few differences between high technology and low technology schools in terms of teachers' access to technology. This is probably because the more technology there is, the more it is used. The high technology schools generally tend to have a higher integration level, and are constantly pushing the boundaries of the available resources.

Teachers at low technology schools are more likely to mention a lack of technology peripherals such as display equipment and software. Teachers at high technology schools are more likely to have a computer in the classroom—but that doesn't mean they have access to it. Teachers say they frequently allow students to use the computer on their desk to help alleviate the students' access problems.

Time is a very frustrating barrier for teachers at both high technology and low technology schools. Their concerns are fairly similar, but there were some differences. Teachers at low technology schools were more likely to be concerned about the time needed to teach students basic computer skills before they could introduce technology into the curriculum. Teachers at low technology schools were also concerned about finding the time to integrate technology into the curriculum. Teachers at high technology schools were more likely to mention concerns about finding the time for technology training.

When asked to envision the role of technology in teaching and learning in five to ten years, teachers generally had a difficult time coming up with a response. When the responses to this question were analyzed in terms of the technology level of the teacher's school, some differences were found.

Teachers from low technology schools were more likely to talk about basic technology use in the classroom as their vision for technology in education. They were much more likely to discuss "real world" applications of technology as part of their vision for the future. They were also more likely to mention solving access and communication problems by issuing laptop computers to all students. And, not surprisingly, those from low technology schools were much more likely to say they had no idea what the future might hold for technology in teaching and learning.

Teachers from high technology schools were more likely to mention high-end computer accessories as a part of their vision for the future – such as digital cameras, scanners, and huge hard drives.

Money barriers are causing problems for both low technology and high technology schools. Teachers at low technology schools are more likely to talk about the impact of financial barriers on software purchases, while those at high technology schools are more concerned with the challenges of remaining current with computer hardware.

In summary, it seems no matter how much technology is available at a school, there are still barriers when it comes to attempting to integrate the technology into the curriculum. Teachers mention a number of barriers, including inadequate training. Teachers in low technology schools tend to express a need for more training on hardware and software, while teachers at high technology schools are more likely to want more information on how to integrate the technology into their specific curriculum areas. Access to technology seems to be a problem for teachers in both high technology and low technology schools as well. Generally speaking, the more technology there is in a school, the more it is used. If this is the case, access problems may not be resolved until there is a computer for every student and teacher. Teachers continue to face a time barrier. They say they need more time to learn to use technology, and time to utilize it in the classroom. The final barrier discussed in this section is the barrier of vision. Leadership and a detailed plan for the future are critical components for success.

Research Question Four:
How Does Technology Enable Iowa Teachers to Change How and What They Teach?

Despite the barriers teachers face in their efforts to integrate technology into the curriculum, there are many success stories. As teachers increasingly use technology in the classroom, they are seeing some important changes.

Teachers report they do less lecturing, and more facilitating. They offer their students more opportunities for individualized, self-directed, and hands-on learning. Some teachers also say that technology has made teaching easier for them, allowing them to handle some tasks more efficiently, and serving as an organizational tool.

The Role of the Teacher

The most common response to the question of how technology changes teaching was that technology has an important impact on the role of the teacher. Teachers said that with the addition of technology in their classrooms, they are now a facilitator of learning. They do not lecture as much, and they give students more responsibility for their own learning:

> I let the kids take control of their learning and become active learners. I've had kids ask me 'what's the difference between being a teacher and being a facilitator?' and I said, 'Well, teachers are sometimes both, maybe not at the same time, but sometimes at the same time. If you want to learn something, then I will facilitate that process for you, and do whatever it takes for you to learn that.'
>
> Using the Internet and CD-ROMs I have to give up something. The kids are learning more on their own. My role changes and in some ways I feel pushed aside, no longer needed. They don't need me as much as before and they know it.

Teachers also acknowledged the appeal of the computer and observed that using technology made teaching and learning more interesting.

> There was a time last year when I felt I was really bored with how I was teaching and what I was teaching and I thought 'Boy, if I'm bored presenting this material, I can't imagine how they are sitting there listening to me presenting this material.' So it's really motivated me and I'm learning a lot of things right along with the kids. There's a lot of learning going on with them, and also with me.

The Role of the Student

Teachers say that the hands-on student-directed approach works well because students are more motivated to learn when they are exploring something of interest to them. "They are doing more for themselves because it's interesting, it's fun to get in there and search the Internet for information. Instead of sitting there and expecting it to be given to them, they go out and get it."

Teachers also talk about the opportunity to motivate learners and to make learning "come alive" for students with technology:

> You know you've got a text book with some pictures in there. When you take a look at all the kids' learning styles, you find out that probably 70% of the kids are …hands-on, some auditory, some visual. How you teach about early America? If I do the virtual reality things with kids, I can make history come alive!

Many teachers mentioned a change in their classrooms related to the use of technology that allows them to individualize lessons for students. "It allows you to individualize a curriculum to the students' abilities, because it's very easy to adjust a curriculum for a very accelerated student, as well as adjust a curriculum to a slower student that might have special needs."

Additional Information Sources

Another important change for teachers is the vastly increased information sources that are available. The Internet dramatically increases the access to relevant and timely information for both teachers and students. This increased access to information seems to have the greatest impact on teachers at smaller schools:

> In a small school like this and in a small community like this, when you go to get research, you need to go to Iowa City or Iowa Wesleyan to get certain types of research. It's just really important to get on there (Internet) and get it right then.

The Internet also expands a student's world, and allows for a much wider perspective, according to some teachers:

> Through e-mail and Internet, you can get a discussion going with another classroom. Or, you can start a discussion with another teacher that the kids can be a part of. And they realize that [the teacher's] opinion isn't the only

> one there is, perhaps there is another interpretation.... For me, for a literature teacher, it is really important to hear other voices.

Another teacher explains how the use of multiple technology resources makes a difference in her teaching and the students' learning:

> I would say that I use textbooks about five percent of the time. My kids have only read about ten pages during the entire semester thus far. And I have used probably one or two worksheets a week. A lot of my curriculum comes from a CD-ROM that I have, and from my own knowledge. And that's probably because I have 10 years of experience as an educator. I wouldn't expect a first year teacher to do that. But it has eliminated in a lot of ways the curriculum constipation. I have to cover this, this, and this. ...And it's forced me to say, 'What are the life skills that these students need?' And because of that, and because I have curriculums that are CD-ROM based, it's forced me to make intelligent choices. And I think what I am doing is more valuable and still covering the same amount of material...but it's being covered in a different way. And because I'm not relying on a book, we have to utilize more projects. And since I'm not giving them ten pages of notes on acid raid, we have to go out and get samples of water from our house and come in and test it and see whether or not our environment's acid. I think that's progress, because it's forming main critical thinking skills.

Increased Efficiency

Another important change in teaching is the ability technology has to increase efficiency. Teachers say technology speeds up the learning process by removing the drudgery of drawing graphs, measuring samples, and charting results. Students can arrive more quickly at a theoretical level which enables them to develop critical thinking skills and to more accurately apply principles to specific cases. "With our technology, we can get more quickly from the knowledge kinds of information to the more important problem-solving that the kids need to do. The technology moves us along that path a lot quicker." A science teacher talks about the benefits he sees for his students because of technology in the classroom: "It [the computer] frees up kids from doing some very boring data collection. And it allows them to get to the nuts and bolts and the guts of a concept a lot faster."

The computer is also an important organizational tool for teachers, for their duties in the classroom and outside of it:

> I think what I like best is just getting into the computer and doing PowerPoint or something… The class just flows better. I don't have to take time and erase what's on the overhead and get the black ink all over my fingers… And I can flip from a diagram back to what I have written down on the overhead without too much trouble.
>
> I use mail merge for several mailings to parents. I am moving towards doing return labels, etc. I have kept track of class records on spreadsheet, I use a lot of management tools, and the grade book. It saves time.

Teacher Cooperation

At a few high technology high schools, teachers talked about the changes they saw in their fellow teachers because of technology integration: "Teachers are coming out of their rooms, out of their departments. They're not so isolated anymore. There's a lot of mobility in teachers." Another teacher said, "We've really gotten into doing that a lot more. I think our staff works really well with one another. If you find a way that's quick to do something, or it's better to do something, they're very willing to share it."

Summary of Research Question Results

Iowa teachers seem to have a common definition of integration of technology into the curriculum. Most teachers see technology as a tool to assist them in their role as a teacher. They describe technology integration as the use of display and presentation software to allow students hands-on educational opportunities, and to allow teachers to more clearly discuss abstract concepts. Some teachers define technology integration as the bridge from school to work. In schools where there is very little technology to integrate, teachers were more likely to discuss the reasons they do not integrate technology than to define the term.

There are a number of barriers that are slowing the progress teachers would like to make in technology integration. The most significant barriers include teacher training, access to technology, time to learn and use technology in the classroom, and lack of a vision for technology use.

There are two key motivations for teachers as they integrate technology into the classroom. One is their own desire to learn and grow. Teachers say they enjoy learning, and technology is an exciting new area for them to explore. The second main reason teachers give for integrating technology into the curriculum is the students. Technology seems to excite and motivate students like nothing else does. Teachers are very aware that their students will need technology skills after high school, and see integrating technology as part of their overall mission to prepare students for the next step. Some teachers also mentioned the efforts of their administrators and technology planning committees as motivations for utilizing technology as part of their teaching.

Teachers describe a number of important changes that they see occurring in the classroom because of technology. The role of the teacher is being transformed from that of the “sage on the stage” to the “guide on the side”. Teachers say technology allows them to become a facilitator of learning. In turn, the role of the student is also changing. Students are directing their own learning, spending more time exploring areas that interest them, and creating products that represent their knowledge in an area. Teachers also say they appreciate the efficiency of technology. They are using technology as a tool to save time and energy as they go about their daily duties.

The Concerns Based Adoption Model

The Concerns Based Adoption Model (CBAM) focuses on two facets of the individual's developmental growth in relation to the innovation. The first is Stages of Concern About the Innovation (SoC), which describes seven kinds of concerns that individuals experience at various times in the change process. The second major dimension of the CBAM is Levels of Use of the Innovation (LoU), for which eight levels have been defined.

LoU describes how performance changes as the individual becomes more familiar with an innovation and more skillful in using it. The LoU makes it possible to analyze the level at which teachers apply and use an innovation.

The comments of the teachers during focus group sessions and the case study report for each school (Appendix C) were used to determine where the school is located on the CBAM continuum. The unit of analysis for this process is the school, using the comments of the teachers along with information from the students, the technology coordinator (if available), the principal, and the technology plan. The data from individuals at each school will be considered as a whole to describe the approximate

Level of Use of technology and Stage of Concerns about the innovation for the school. Some schools were not included because there was not adequate information in the focus group transcription to make a determination of the appropriate placement on the continuum.

The names of the schools are fictional. Each of the participants at the 30 high schools visited was promised confidentiality. Names of trees were randomly assigned to the 30 schools in this study. Those names are reflected in the following two tables, as well as in the case study reports in Appendix C.

Stages of Concern

The majority of the schools are in the self (Stages I and II) sequence of the Stages of Concern. As is evident in Table 4.2, the Personal Stage of Concern has the greatest number of schools. Eleven schools had teachers who appeared to be predominately concerned about their capabilities for using technology in the classroom. Only one school appears to be in the awareness stage, and three schools appear to have progressed to the collaboration stage. None of the schools is in the refocusing Stage of Concern.

Cedar High School was placed in the Awareness Stage (0) because teachers there did not appear to be interested in using technology, and they did not seem to be seeking additional information about technology, even though computer resources were easily accessible. One teacher at Cedar High School said, "I am not willing to spend

Table 4.2. Stages of concern: Typical expressions and stages of schools.

Stages of Concern	Typical Expressions or Indications of Concern	School Name
0. Awareness	I am not concerned about or involved with the innovation.	Cedar
I. Informational	I would like to know more about it. Interested in general characteristics, effects and requirements for use.	Box Elder, Butternut, Hawthorn, Orange, Palm, Tamarack,
II. Personal	How will using it affect me? Individual is uncertain about the demands of the innovation and adequacy to meet those demands.	Alder, Ash, Basswood, Beech, Catalpa, Cherry, Cottonwood, Hemlock, Hickory, Plum, Willow,
III. Management	I seem to be spending all my time getting material ready. Attention is focused on the process and tasks of using the innovation.	Maple, Pine
IV. Consequence	How is my use affecting kids? Focus is on the relevance of the innovation for students.	Birch, Joshua, Oak, Orange, Palo Verde, Redwood, Spruce,
V. Collaboration	I am concerned about relating what I am doing to what other instructors are doing.	Apple, Aspen, Elm
VI. Refocusing	I have some ideas about something that would work even better.	NONE

time to show something [using technology], because I need to show students how to do the math." Another teacher said, "If technology does not increase achievement, I don't see why to use it."

Teachers at schools in the Informational Stage of Concerns (I) were asking for additional information in an effort to become more knowledgeable about the technology that currently exists in their school. "The kids have this stuff at home. If we don't learn it, we can't help them use it."

The teachers at the eleven schools categorized in the Personal Stage of Concerns (II) discussed the impact technology would have on them in terms of changes they may need to make in their teaching style. These teachers also expressed concerns about their ability to use technology in the classroom. "I feel like I haven't gotten the support that I need. I don't have the time to figure it out for myself even though I know that I should."

Two schools had teachers who seemed most concerned about task issues. Teachers at Maple High School and Pine High School were most concerned about the additional time that is needed with technology integration, and are at Stage III, Management. "There is not enough time to learn how to use it, or to use it in the classroom." "We are moving towards more teachers teaching six periods each day, which leaves 49 minutes of planning time daily."

Teachers at seven high schools appeared to be most concerned with the impact technology use would have on students, and are at Stage IV, Consequence. Technology "opens more doors for students," and the "access to information is unending," according to one teacher. Another teacher says, "Parents really shudder about calculators if students use them for mindless things, but I try to make them use them to discover concepts that [they] couldn't have before because it was too time-consuming."

Teachers at three high schools were focused on how to work with other teachers to enhance technology use throughout the school, and appear to be at Stage V, Collaboration. "Teachers are coming out of their rooms, out of their departments. They're not so isolated anymore." "If you find a way that's quick to do something, or it's better to do something, they're very willing to share it."

Levels of Use

When examined in terms of the Level of Use framework (Table 4.3), all of the schools in this sample fit into Level II, Preparation, through Level V, Integration. None of the schools appear to fit in the first two levels or the last level of the framework.

The first three levels of the framework (Nonuse, Orientation and Preparation) are considered "nonuse" categories. Six schools in this sample appear to fit the criteria for this category, all at the Preparation Level. Some of these schools are at this level because of lack of access to technology. "I like to do research, but classes are in the Mac lab when I want to use it. Sometimes I want them to take a test or write a report, but they can't get there during class. Some will have to hand write them."

The remainder of the schools fit into the "use" categories. A number of teachers at nine schools made comments that indicated they were using technology, but not integrating it well, and were at Level III, Mechanical Use. Most of these schools have technology, and are using it to some extent in the classroom, but there are difficulties. Often, the biggest problem is insufficient or inadequate training. In reference to in-service training on Windows '95, one teacher said, "Training occurred three months before we got the program. If training doesn't match our needs, we can't use it."

Teachers at three schools reported information indicating they were at Routine Level IVa, with an established pattern of use. "I have become a facilitator, not just a teacher." "The kids are learning more on their own and my role changes." "They don't need me as much as before and they know it."

Two schools were at Refinement Level IVb, and working to increase user outcomes. "In general, we have kids that learn to use them [computers] when they are four or five. If you don't have it [technology] when they get to high school, they're gonna say 'Where's the computer?'" These schools are past the stage where they struggle with how to use technology. They tend to focus on integration of technology and multiple technology tools to accomplish learner outcome goals.

Teachers at three schools indicated they had advanced to the Integration Level of Use V, making deliberate efforts to coordinate with other teachers in using technology. Even the students are aware of the cohesiveness of the faculty at one high school: "I'd like to do more projects, but when one teacher hears what someone else is doing, then they try to do the same thing." Teachers at this school admit that they are a more cohesive group because of they way they now work together on technology issues and problems.

Table 4.3. Levels of use: Typical expressions and levels of schools.

Level of Use	Behavioral Indices of Level	School Name

0. Nonuse	No action is being taken with respect to the innovation	NONE
I. Orientation	The user is seeking out information about the innovation	NONE
II. Preparation	The user is preparing to use the innovation	Ash, Box Elder, Cherry, Cottonwood, Maple, Orange
III. Mechanical Use	The user is using the innovation in a poorly coordinated manner and is making user-oriented changes	Alder, Catalpa, Cedar, Cherry, Hemlock, Pine, Plum, Tamarack, Willow
IVa. Routine	The user is making few or no changes and has an established pattern of use	Birch, Palo Verde, Redwood,
IVb. Refinement	The user is making changes to increase outcomes	Spruce, Walnut
V. Integration	The user is making deliberate efforts to coordinate with others in using the innovation	Apple, Aspen, Elm
VI. Renewal	The user is seeking more effective alternatives to the established use of the innovation	NONE

These two diagnostic dimensions, Levels of Use and Stages of Concern, are independent concepts. A person or school can be at any particular Stage of Concern or Level of Use at any given time. It is important to remember that change is a process and not an event. Constant assessment of the Levels of Use and Stages of Concern are needed in order to effectively respond to the needs and perceptions of teachers.

The placement of schools into the CBAM framework indicates, as expected, a wide range of variation in the needs of teachers at schools across the state. The usefulness of this diagnostic framework is the predictability of advancement through the stages. If the changes in teachers' concerns can be predicted throughout the technology integration process, in-service and other interventions can be designed to address concerns as they emerge, smoothing the change process and encouraging increased technology integration. Since teachers tend to be one of the most critical components of the technology integration process, they are the obvious targets of the interventions. A discussion of the implications of this is included in the following chapter.

Summary

This chapter reported the results of the study within the framework of the four research questions, and within the framework of the Concerns Based Adoption Model. The next chapter summarizes the study, discusses the results of this study in the context of the current body of literature and provides recommendations based on the results.

CHAPTER 5. DISCUSSION

Introduction

Many believe technology is the tool that can fix what is wrong with education (David, 1994; Means, Blando, Olson & Middleton, 1993). As the amount of technology going into our nation's schools continues to increase (Technology Counts, 1998), it is important to understand how it is being used in education. This qualitative study focuses on the process of instructional technology integration from the perspective of the teacher.

This chapter will summarize the study and discuss the results in the context of the existing body of research, as well as provide recommendations based on the results of the study, and suggestions for further research.

Summary of the Study

This formative study is based on focus group interviews with nearly 200 teachers at thirty Iowa high schools during the Spring of 1998. During the one-day site visits at each school, data was also collected from students, the principal, and the technology coordinator (where available). During the one-hour focus group sessions teachers were asked about how they use technology, how they define technology integration, what motivates them to integrate technology, what barriers they face, how technology is changing teaching and learning, and what they believe the future holds for technology in education.

Findings indicate that Iowa teachers are progressing well with technology integration. Iowa is ahead of the national average with most types of technology in the schools, including the ratio of students to computers. Teachers say they see technology as a tool to help them better accomplish their educational goals with students. They say technology changes both what they teach and how they teach.

The enthusiasm Iowa teachers have for learning is the biggest factor motivating them to integrate computer technology into the curriculum. Teachers say they enjoy learning, and technology is an exciting new area for them to explore. Students are also enthusiastic about using technology as a tool to learn, and teachers say that enthusiasm for the technology translates into increased learning of content for their students.

Teachers face some difficult barriers as they attempt to integrate computer technology into the curriculum, including inadequate training, inadequate access to technology, and lack of time to learn and use technology. These barriers seem to be faced by teachers everywhere, regardless of whether the teacher is at a high technology or low technology school.

Despite the barriers, there are changes occurring in teaching and learning because of computer technology in the classroom. Teachers say technology makes it possible for them to become a facilitator of learning rather than a lecturer. Both teachers and students say students are taking more responsibility for their own learning, and there are more opportunities for individualized and hands-on learning.

Conclusions and Discussion of Results

Generally, education continues to look much like it did decades ago (David, 1994). However, as teachers integrate computer technology into the curriculum, changes will become more evident. Even in schools where technology was being used in very basic ways (word processing and Internet research), both teachers and students mentioned changes in teaching and learning. This outcome is more positive than much of the previous research on the impact of technology in education (Gormly, 1996; Moersch, 1997; Zappone, 1991).

The results of this study are very similar to studies done across the nation. For the most part, Iowa teachers are using computer technology in the same ways, they are being challenged by the same barriers, and they are enjoying many of the same positive outcomes of technology as teachers in other states.

The primary uses for computer technology reported by teachers in this study were word processing and Internet research. When asked to define technology integration, the majority of teachers in this study described using technology as a tool to accomplish educational goals. Hadley and Sheingold (1993) found that teachers who had truly integrated computer technology into the curriculum used computers as multipurpose tools. This may indicate that teachers, even if they are not currently using technology in the classroom, understand that the power of technology lies in the fact that it is a multipurpose tool that can be used in many ways in the classroom.

Hadley and Sheingold also found that what teachers did with computers in their classrooms reflected how much experience they had. This was clearly articulated by one teacher as she explained how her teaching had changed because of technology in the classroom:

> I would say that I use textbooks about five percent of the time. My kids have only read about ten pages during the entire semester thus far. And I have used probably one or two worksheets a week. A lot of my curriculum comes from a CD-ROM that I have, and from my own knowledge. And that's probably because I have 10 years of experience as an educator. I wouldn't expect a first year teacher to do that.

Teachers at low technology schools are more likely to struggle with basic technology applications, such as PowerPoint slides for lectures, because of their relative lack of experience with integrating technology. The teachers in this study generally agree with Hadley & Sheingold's finding that it takes five or six years before a teacher feels comfortable using technology in the classroom. The length of time a school has been exposing teachers to technology seems to be connected to the amount of progress a school has made with technology integration. As Hadley and Sheingold explain, that time is needed in order to build the foundation from which teachers can flexibly make choices about using new applications and using familiar applications differently (Hadley & Sheingold, 1993).

Teachers report that technology has an impact on their teaching style. Pisapia (1994) found teachers who adopt a technology-based approach usually "progress from presenter to coordinator of learning resources, thus freeing them to work individually with students. They move from being the 'sage on the stage' to the 'guide on the side'" (p. 3). Teachers in this study echo that finding. Some teachers say it is a difficult transition for them, but one they ultimately find rewarding.

What motivates teachers to integrate technology into the curriculum? A national study (Hadley & Sheingold, 1993) found the most important incentive for teachers to integrate technology is the benefits for students. Iowa teachers say the primary motivation is their own love of learning. The impact technology has on student learning is the second most frequently cited reason to integrate technology.

The research indicates there are some significant roadblocks slowing the integration of technology in the classroom: lack of adequate teacher training (Coley, 1997; Dradowski, 1990; Dupagne & Krendl, 1993), lack of access to technology resources for teachers (Cummings, 1995; Ellmore, 1993), and resistance to technology (Marshall, 1995; Terrell, 1995; Wesley, 1996). The results of this study indicate teacher training and access to technology are serious barriers, but teacher resistance to technology was not evident.

Iowa teachers say technology training is the most significant barrier to technology integration. Many teachers say they need more training before they can effectively use technology in the classroom. Because educators have widely varying degrees of computer proficiency, it is critical the training be flexible and focus on meeting individual needs. It is also important that the training be process oriented. Teachers must develop the skills needed to address the rapid accumulation of information and constant advances in computer technology (Hirumi & Grau, 1996).

Teachers in technologically advanced schools want more information on how to integrate technology into their curriculum, while teachers at low technology schools are more likely to want basic information on the use of hardware and software.

Technology can be a valuable resource for teachers to use in the classroom. Before teachers can benefit from this rich resource, however, they must have access to the hardware and software. According to the Office of Technology Assessment, a key factor that affects how teachers use computers is the location of the computers within the school building. Access to a computer lab allows the teacher to use computers with the entire class, but unless the teacher also has a computer in the classroom, it is difficult for the teacher to integrate computer technology with other learning activities throughout the day (OTA, 1995).

Teachers in this study expressed frustration with access barriers. Those who have struggled through training barriers and feel ready to use technology in the classroom are frequently stopped by access barriers. Most Iowa teachers rely on computer labs (rather than computers in the classroom) to provide their students access to computers (Iowa Department of Education, 1998). Teachers say those labs are regularly scheduled for keyboarding, business or programming classes, making it impossible for teachers in other curricular areas to integrate technology.

Iowa teachers in both high technology and low technology schools reported access barriers. As the level of technology integration increases in a school, so does the demand for technology resources. Until there is a computer for every student, access barriers, to some degree, will continue to exist.

It is important to note, however, that access is not the only answer. Some schools located in the nonuse category of the Levels of Use continuum had very adequate technology resources for teachers and students – they simply were not using them. An abundance of computers does not necessarily mean an abundance of computer users.

According to previous research, one roadblock for innovations such as technology in the classroom is teacher resistance (Marshall, 1995; Terrell, 1995; Wesley, 1996). “Technology adoption is seen to involve the alteration of often deeply held beliefs and values regarding teaching methods, education, and the proper roles of teachers and students” (Wesley, 1996, p. 2). In some Iowa teacher focus group sessions, it was mentioned that teachers who were very close to retirement age were less likely to be technology users. In general, however, Iowa teachers did not discuss teacher resistance to change as a barrier to technology integration.

A well drafted technology plan appears to be a critical component for successful technology integration. The Iowa Legislature mandates that all Iowa school districts write a technology plan that addresses the ways technology can be used to support the improvement of student learning. The technology plan allows schools to determine what technology should be purchased, how it will be used, and how it will benefit teaching and learning. Teachers say the school technology plan helps make technology accessible to them, which in turn motivates them to integrate technology into the curriculum. Schools in the upper levels of the LoU continuum are more likely to have a clearly written and well-communicated technology plan.

The Concerns Based Adoption Model emphasizes understanding teacher attitudes and skills so that support activities, such as staff development, coaching, provision of resources, and so on, can be directly related to what teachers perceive they need. In many districts across Iowa, it appears teachers are provided with training and resources based on something other than an understanding of teachers' needs.

There is great variability in the level of technology integration in Iowa schools. Some are just beginning to bring technology into the school, while others have been working on technology integration for nearly a decade. Despite the variability in the amount of technology, schools face many of the same barriers to integration.

A significant barrier, according to teachers, is technology training. This is reflected in the concentration of schools in the Mechanical Use Level of the LoU framework and in the Personal Stage in the SoC framework. In the Mechanical Use Level, users struggle to master the tasks needed to use technology, resulting in superficial uses. The high number of schools at this Level of Use is reflected in the fact that the majority of the schools visited were using technology in very basic ways, such as word processing and Internet research.

The high level of Personal concerns in the Stages of Concern framework also indicates a need for additional training. Teachers at this stage tend to feel their technology skills are inadequate. Additional targeted training can help alleviate these concerns, increase their confidence level, and encourage continued use of technology in the classroom.

One of the reasons why change processes, such as the integration of technology, are not successful is because interventions are not made at the appropriate times, or in ways perceived by teachers as relevant. Specific intervention plans need to be addressed for each specific teacher at each school, and as change occurs, plans must be updated.

Many of the teachers at schools in the nonuse category of the LoU indicated technology was essentially dumped on them, and they were left to struggle and discover through trial and error how to use it. When a concerns-based approach is used, change facilitators work in conjunction with teachers to address their emerging and evolving needs. This is true for all the Stages of Concern and Levels of Use.

There is no "recipe for success" or "cookbook approach" to successful technology integration. The CBAM framework allows change facilitators to organize the behaviors and concerns of teachers in an effort to plan interventions. Typically those interventions will include training in one form or another.

Recommendations

The findings from this study suggest some approaches that Iowa schools might take in order to continue to increase the integration of computer technology technology. Three key areas need to be addressed if the process of technology integration in Iowa schools is to improve: teacher training, access to technology, and the vision for instructional technology.

Training

Teachers say they are very frustrated by the ineffectiveness of the technology training they receive. Teachers have a wide variety of training needs that remain unmet. Some teachers are still struggling to learn the hardware and software basics. Others need training in how to integrate technology into their curriculum area. Schools that have adopted a "train the trainer" model appear to have met with more success than schools employing other models. This approach allows teachers to rely on each other for one-on-one training, ensures an on-site expert, and encourages increased collegiality among teachers as they work through technology problems. Technology training must be timely and ongoing, appropriate for the teacher's current technology level, and relevant to the teacher's needs.

Access

Teachers mention access to technology as one of the most difficult barriers they face as they attempt to integrate technology into the curriculum. If technology is to be successfully integrated in the curriculum, both teachers and students must have adequate access. As more schools refine the technology planning process, access problems are slowly being addressed. Teacher access is best served by placing a computer on every teacher's desk. Student access is best served by providing pods of computers (8-10) in each classroom, and by providing additional computer resources in mobile labs that can be brought to the classroom when needed.

Vision

The technology plans mandated for all Iowa schools are an important part of successful technology integration. The written plans force school districts to determine a long range plan for what technology they will purchase, and how technology will be used to support the improvement of student learning. This planning is done by a committee typically made up of teachers, administrators and community members.

At least one person on that committee needs to be the holder of the vision for what technology in education will look like in the future. That person is often a principal or superintendent, but can also be a teacher or a group of teachers. The vision holder or change agent for an organization is not a title that can be assigned to one person, then forgotten. Change facilitation is a shared responsibility that, in the most successful schools, involves everyone at one time or another. This state needs a program aimed at developing strong leaders for today's schools with emphasis on communicating the vision of technology use in education. The Iowa Communications Network (ICN), a statewide fiber optics network with a point of presence in nearly every school district in the state, could be used to connect vision holders in school districts across the state. This would allow for the sharing of information, group problem solving, and encouragement, as well as training.

Teachers at schools across Iowa need to see what works when it comes to technology integration. More efforts need to be made to allow teachers to share success stories. Exemplary technology-using teachers should be high profile in their school, their district, and statewide. By sharing strategies and approaches, it is possible that other teachers can model their techniques and move more quickly toward an exemplary level.

Suggestions for Further Research

This study brings to light a number of areas that are appropriate for further research:

How is teaching really changing because of technology? This study was based on teachers' self-report, and found some important reported changes in teaching. A study using classroom observation techniques combined with other methods such as teacher interview, student interview and document review could more accurately and specifically determine the changes that have occurred.

What kind of training approaches are really most effective for teachers struggling with technology integration? What kind of training do teachers actually need? When do they need it? This study revealed teachers are frustrated with technology training, and changes are needed in some areas. A study is needed to determine specifically what changes in teacher training would be most beneficial.

What solutions are most effective for schools as they struggle with access issues? Will it really take a computer for every student to provide adequate access for everyone?

Does the use of technology in education really improve student outcomes? Teachers and students say technology makes a big difference in motivating students to learn, and therefore students are learning concepts at a deeper and more personal level. How can the connection between technology and student outcomes be made empirically?

Summary

Findings indicate that Iowa teachers are progressing well with technology integration. Iowa is ahead of the national average with most types of technology in the schools, including the ratio of students to computers. Teachers say they see technology as a tool to help them better accomplish their educational goals with students. Teachers and students indicate technology changes both what teachers teach and how they teach.

The enthusiasm Iowa teachers have for learning is the biggest factor motivating them to integrate technology into the curriculum. Teachers say they enjoy learning, and technology is an exciting new area for them to explore. Students are also enthusiastic about using technology as a tool to learn, and teachers say that enthusiasm for the technology translates into increased learning of content for their students.

Teachers say they face some difficult barriers as they attempt to integrate technology into the curriculum, including inadequate training, inadequate access to technology, and lack of time to learn and use technology.

Despite the barriers, there are changes occurring in teaching and learning because of technology in the classroom. Teachers say technology makes it possible for them to become a facilitator of learning rather than a lecturer. Both teachers and students say students are taking more responsibility for their own learning, and there are more opportunities for individualized and hands-on learning.

APPENDIX A:
CORRESPONDENCE WITH PRINCIPALS

Phone Call to Principal

- Hi this is ______ with the Technology Research and Evaluation Group at Iowa State University.
- I'm working on the statewide Star Schools evaluation, gathering baseline data on the integration of technology in Iowa high schools. The data will be used by policy makers at the state and federal levels.
- We'd like to have a team of two researchers spend most of a day visiting your high school, and would like to spend some time talking to you
  - your approach to promoting technology integration.
  - will take about an hour
  - would like a walking tour of the school
- We would also like to conduct two focus groups.... one with teachers and another with students.
  - Will discuss integration of technology in the curriculum
  - 45 minutes - 1 hour for each discussion
  - Would you be able to arrange to have about 8 students available in the early afternoon - perhaps a cross-section of students in the study hall right after lunch?
  - We'll also like to meet with about 8 teachers from a variety of content areas - right after school - can you set that up?
  - We need to have special permission to include anyone under 14 in our focus group. We'll send you release forms to distribute to the students who might be under that age.
  - we'd like to have cookies and drinks available for focus group participants - is there someone at your school we could contact to set that up?

Artifacts:

- school technology plan
- any technology survey results you might have
- information about any staff development activities involving technology
- any evaluations of technology-based staff development

Before you get off the phone:

- set tentative date for visit
- set tentative time for focus groups
- set time for meeting with principal
- ask for needed artifacts
- ask if they have any questions

Principal Name
______ High School
Address
City, IA 00000

Dear _______,

Thank you for agreeing to allow us to conduct Star Schools research at your high school. We are gathering baseline data on the integration of technology at Iowa high schools, data that will be used for Star Schools evaluation and by policy makers at the state and federal levels. As we discussed on the phone, we plan to interview you, do a brief walking tour through your school to look at your technology, and conduct focus groups with students and teachers.

Here is our tentative agenda:

We would like a copy of your school technology plan, copies of any technology survey results you might have, and information about any staff development activities conducted in the past year involving technology. In addition, we would like a description of your high school (similar to the description typically used in grant proposals).

Thank you again for your cooperation with this research. If you have any questions or concerns, please contact me.

Sincerely,

Lynn Manternach
Technology Research and Evaluation Group
(515) 294-2438
lynnman@iastate.edu

APPENDIX B:

INFORMATION FOR ASSISTANT RESEARCHERS

FOCUS GROUP INTERVIEW PROCEDURES

Technology Research and Evaluation Group
Iowa State University
College of Education

FOCUS GROUP PROCEDURES

Site Visit Team Focus Group Members

A minimum of two site visit team members will attend each focus group. One person will serve as the moderator/facilitator and the other as the observer/recorder. Instructions for these roles are included in these procedures.

Getting Started

Food

Providing food has been shown to facilitate group conversation and provides the moderator a chance to assess group characteristics. If possible, the site visit team should provide refreshments.

Seating

It is recommended that the most talkative respondents be seated on either side of the moderator and the least talkative across from the moderator. This allows the moderator to provide non-verbal encouragement to the less talkative members. Allowing some informal interaction time prior to the actual focus group (for example, coffee/refreshment time) may assist in identifying those who may be most or least talkative.

Introduction to Focus Groups

Establish Trust

- Introduce the purpose of the study
- The nature of the organization conducting the study
- How members were selected
- Planned use of the data and conditions of confidentiality
- Emphasize that you are there to learn from them
- Explain the usefulness of audio taping and the participant's right to decline
- Ask permission to audio tape

Establish Ground Rules

- Only one person speaks at a time
- No side conversations among neighbors
- Everyone participates and no one dominates
- All experiences are valid and legitimate

Provide Verbal Instructions for Self-Managed Groups

- **Legitimate members' right to manage the discussion.**

"If you tend to get off track, someone will usually pull the group back to the topic. We'll jump in if we have to, but usually one of you takes care of that for us."

- **Cue them on handling common problems.**
  "If the group runs out of things to say, just remember what we're interested in is how the use of new technology has affected this company and we want to hear as many different points of view as possible. What usually happens is that someone will think of something that hasn't come up yet and will restart the discussion."
- **Emphasize that you want as many different points of view as possible.**
  "If your viewpoint is a little different, then that is exactly what we want to hear. Often, someone thinks 'I guess my view is different from everyone else's' and then they find out that other people have the same views, but no one would have mentioned it if someone didn't start the ball rolling."
- **Get them to use questions to direct the flow of interaction.**
  "If someone hasn't really joined in, or you seen to be hearing from the same people all the time, try asking a question of someone who hasn't spoken as much."
- **Emphasize hearing about their experiences.**
  "We want to hear as many viewpoints as possible. Even if you think your viewpoint is just like everyone else's, don't just say I agree. We want you to tell us your view because there is always something unique in each persons own experience."
- **Emphasize that all experiences are equally important.**
  "We need to hear as many different things from as many of you as time allows. There aren't any right or wrong answers. We are here to learn from you."

Introduce an Ice-Breaker Activity

Each person should be provided with a name tag/name tent (if the room used for the focus group has tables).

To get the group started, ask each person to make an individual statement (this also provides the moderator with more information about the participants).

- Ask each participant to tell you his/her name
- Describe what he/she does in the company (work position)
- Tell how many years he/she has been with the company
- Share a favorite non-work (recreational) activity.

Dealing with Late-comers

Do not include anyone arriving after the opening statements have ended.

A sign may be placed on the door indicating that the session is not to be interrupted.

The Discussion

Asking the Questions

- Memorize the questions (and introduction). Do not refer to notes.
- Start with a general question so that discussion is not restricted.
- Questions should be asked in a natural progression.
- Only 3-5 broad questions should be introduced in a focus group. The moderator may have some sub-questions in mind, but should not dominate discussion.

- The moderator introduces the questions, followed by unstructured group discussion until the moderator introduces a second question. Time criterion can be used to divide discussion between topics.
- Generally, before going on to the next question, the moderator summarizes for the group to check out perceptions. This allows participants to clarify and correct.
- The moderator may also check with the recorder to see if he/she has any other questions to ask the group. Generally, the recorder does not participate in the discussion except at this point.

Moderating the Discussion

Low level of moderator involvement is recommended.

- Do not want an imposed agenda if want to learn something new.
- Important for content analysis, otherwise results reflect what moderator (not participants) thought was important or interesting.
- Helps control for moderator bias when using multiple moderators.
- Role is to moderate someone else's discussion and not to interview.
- Moderator who appears to be an expert will shut off lines of discussion. Need enough knowledge to probe for details, but must be open to information contrary to the moderator's own knowledge.

Take Care Not to "Lead" the Discussion

- Avoid mention of specific terms and over-cueing participants to responses.
- Direct discussion to concrete and detailed accounts of experience, not generalizations. "Think back" is a common device to put participants in a frame of mind to provide details.
- Avoid following a guide too rigorously. Probe when necessary, skip if already covered, and follow new topics as they arise.
- Use participant statements to introduce new topics. Track the discussion (by moderator taking brief notes) and refer to material the participants mentioned earlier as a mechanism for moving to the next topic.

Remain Neutral and Aware

- Encourage responses, but do not agree or disagree. The moderator must remain neutral to the content.
- Be aware of non-verbal behaviors. Watch for discrepancies between verbal and non verbal behaviors. Examples of non-verbal behaviors to watch for include: folded arms across chest, leaning back in chair, moving away from the table, less than usual eye contact, and few nods of agreement in response to others' contributions.
- Moderator listens more than talks. Must be a reflective listener.

Role of the Observer/Recorder

The role of the observer/recorder is to capture the affect, body language, sequential nature of the context and the key ideas (categories or themes) revealed through the discussion. The observer/recorder should:

- Sit away from the group
- Label and audio tape and begin the tape recorder after the introduction (after permission is granted by participants to be recorded).
- Serve as a timekeeper for the moderator. Be sure to arrange cues prior to the interview session.
- Create a seating chart (room arrangement and numbered respondents).
- Record salient information (from ice-breaker activity) about each participant next to their numbered identifier (from the seating chart).
- Identify speakers in notes by participant number.
- Record key themes and ideas and who introduced them by participant number.
- Watch for non-verbal behaviors and record them in notes with participant number. Examples of non verbal behaviors to watch for are listed above.
- Record interactions between participants by participant numbers.

Ending the Focus Group

- Allow each person to make a summary statement.
- Thank participants.
- If there is reason to believe that participants have not shared fully or may be able to provide more information, allow some flexibility to schedule individual interviews.

Analyzing the Data

Ideally transcription of recorded interviews is the best database for analysis. However, due to time constraints, several suggestions are provided here for less time-consuming analysis.

- Have a debriefing with team members participating in the site visit.
- Have moderator share impressions of the interview.
- Have recorder verbally share interview notes.
- Discuss and summarize the interview.
- Have one team member type up summary (generally this will be one of the members who attended the focus group).
- Avoid premature conclusions that can lead moderators to bias later groups.

Things to Remember to Take to the Interview

- Food
- Audio recording equipment and tapes
- Copy of Focus Group Procedures and Questions
- Notepads, pens/pencils
- A notebook or other hard surface for the recorder to write on
- Post-it sheets and masking tape (if using 3rd person flip-chart method)
- Name tags/name tents and markers
- Sign for the door

Things to Remember to Cover in the Introduction

- Purpose of study and who involved
- How selected for participation
- Use of data and confidentiality
- Permission to tape record and why needed
- Ground rules
- Instructions for self-managed groups
- Ice Breaker activity

Individual Interviews

- One hour individual interviews should be scheduled.
- Use the same questions provided for the focus groups.
- Be prepared to explore questions more fully; begin with general question, but may ask more detailed questions.
- Use the same general guidelines provided for the focus groups.
- Interviewer will take notes; a recorder may or may not be present.
- Audio-tape the interviews (unless the person being interviewed objects).

Use of Focus Groups for Research[1]

Definition

Using a semi-structured group session, moderated by a group leader, held in an informal setting, with the purpose of collecting information on a selected topic.

Purpose

To understand from the perspectives of the participants. Cannot be lifted out of context.

Reasons for Using Focus Group Method

Can interview same number of people in less time
Can collect "rich" data at a reasonable cost
Can explore topics and generate hypotheses
Group interaction brings out materials that would not come out either with observation or in response to preconceived questions.

Broad criteria for focus groups

Range:	Maximum range of relevant topics; breadth of experiences
Specificity:	Data that is as specific as possible; detailed descriptions.
Depth:	Foster interactions that explore participants' feelings
Context:	Take personal context into account; individual meaning

Focus groups are not used as a consensus building technique. A "bandwagon effect" lessens the usefulness of the data.

Planning a Focus Group

Duration:	1-2 hours. General rule, plan for less time than you tell participants. For example, tell participants it will be two hours, then plan for 1 1/2 hours.
Number groups:	3 to 6 different groups should be used
Number participants:	4-12 per group (over invite by 20% to cover for no shows). Generally people are more comfortable in small groups (4-6) and each has more opportunity to talk.
Subgroups:	Needed if there are differences in background or role-based perspectives. In an organization where individuals have various positions, there is a probability

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[1] Much of the information for this packet was taken from Focus Groups as Qualitative Research (1988) by David L. Morgan.

	that discussions will degenerate because of refusal to share or uncontrollable conflict. General rule is to keep groups homogenous in terms of prestige or status, such as occupation.
Sample:	Systematically selected samples (purposive sampling). Concentrate on those that are going to provide the most meaningful information. When organizations are being studied, include respondents with different associations with the organization (different roles). Suggested way to identify participants is to begin with a key contact and ask that person for referrals.

General Rules for Focus Group Questions

Do not explore too many topics
Limit discussion to 2-5 questions
Use a structured guide to aid in analyzing across groups
Prior team consensus on what questions to include and at what level of detail
The way questions are asked is crucial. They need to be in a familiar language, using words that make sense to the participants.

Deciding on questions to ask

- Prepare full list of questions, then order them into categories, then develop summary topics
- Use the summary topics for developing questions to use in the focus group
- Do not ask direct questions
  - Boring and slow-paced
  - Participants cannot spontaneously introduce a topic or cut off a topic
  - Participants may answer even if they are uninformed
  - Creates a moderator dominated discussion

Kinds of questions

Experience/behavior	to elicit descriptions of behaviors, actions, activities
Opinion/value	to find out what people think about a program
Feeling	to understand the emotional response of people to an experience
Knowledge	to find out what respondents consider factual information
Sensory	to determine sensory stimuli respondents are sensitive to
Background	to locate respondent in relation to other people

Taping

- Use of audio tape is common
- Video taping not recommended
    - More cumbersome
    - More intrusive
    - Creates lighting problems
    - greater invasion of privacy
    - Tends to "cool things down"

Questionnaires

- Common to use in addition to interviews. Some contamination of data occurs.
    - Questionnaires first directs group discussion
    - Group discussion first may change attitudes

References:

Anderson, Mandi and Mari Kemis (1997). Focus Group Interview Procedures (for use in Higher Education 615c). Research Institute for Studies in Education, Iowa State University, Ames, IA.

Krueger, Richard A. (1994). Focus Groups: A Practical Guide for Appplied Research, second edition. Sage Publications, Thousand Oaks, CA.

Morgan, David L. (1988). Focus Groups as Qualitative Research. Sage Publications,Newbury Park, CA.

Nierenberg, Gerald, and Henry Calero (1971). How to Read a Person Like a Book. Simon & Schuster, New York, NY.

Sorensen, Chris and Jan Sweeney (undated). Focus Group Interview Procedures. Research Institute for Studies in Education, Iowa State University, Ames, Iowa. (Editors of original packet)

APPENDIX C:
CASE STUDY REPORTS

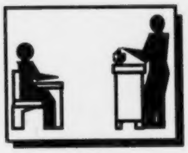
Please Note

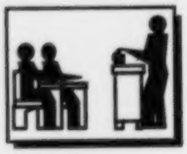
The names of the schools in the following case studies are fictional. Each of the participants at the 30 Iowa high schools visited was promised confidentiality. Therefore, attempts were made to provide a clear description of the situation at each school, without revealing the identity of the individuals or the schools.

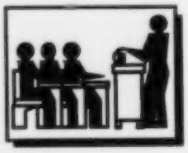
Five authors contributed to these case studies: Lynn K. Manternach-Wigans, Caryl Bender, Nancy Maushak, Shirley Walrod, and Rhea Walker. The case studies were edited by Lynn K. Manternach-Wigans.

Key to Icons

District Size

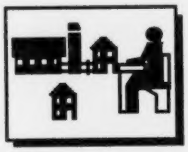

Small

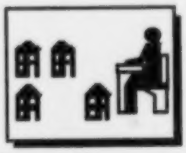

Medium

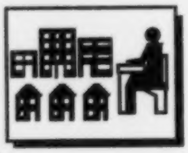

Large

District size is determined by district enrollment. For the purposes of this study, a small school is in a district with enrollment of fewer than 599 students. A medium-sized school is in a district with between 600 and 999 students, and a large school is in a district with more than 1000 students.

County Population

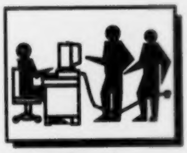

Rural 1

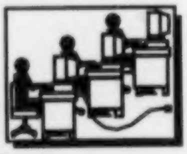

Rural 2


Urban

Population density is determined by the number of people who live in the county where the school is located. A Rural 1 (R1) school is located in a county with a population of less than 2,500 people. A Rural 2 (R2) school is located in a county with a population between 2,500 and 19,999, and an Urban school is located in a county with a population greater than 20,000.

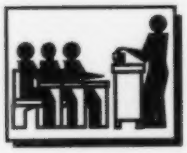
Technology Level


Low Tech


High Tech

Technology level was determined by examining the Iowa Department of Education Technology Survey statistics for the number of pupils per computer within each district. Two schools were chosen within each of Iowa's 15 Area Education Agency (AEA) regions. One school is has a high number of pupils per computer within that particular AEA (low technology school), while the other has a low number of pupils per computer (high technology school) within the AEA.

Alder High School


Large

Rural 2

Low Tech

Setting

Alder High School is in a small Iowa community, and serves four other nearby communities. The high school is tucked into a well-established residential neighborhood. It is a large, two-story brick building with glass door entrances and lots of windows. Although the building is old, it is clean and very well-maintained. We were greeted warmly at the front office when we arrived, and quickly welcomed by the principal.

Technology

"Access (to technology) is a problem for students and will be for about five more years. For teachers, access to technology will be okay next year," according to Alder High School's technology coordinator.

There are five computer labs with Internet access for the students to use: the business lab has 31 Macintosh computers, the IBM word processing lab has 24, another IBM lab offers 11 computers, the drafting lab has 12 computers available with computer-aided drafting (CAD) software, and the library has 11 computers available for word processing. In addition, there is a computer in some of the classrooms, including music, science, math, and two computers in the art classroom. There are also three computers available in the guidance office, and two computers used with the electronic card catalog in the library. All classrooms have a television and VCR.

All of the labs have printers, but none of the classrooms have a printer unless the teacher is willing to have the costs come out of the classroom budget.

Uses of Technology

The technology education classroom uses Digiac 3000, a computer based program that has been in place for about five years. It uses self-paced learning modules and a cooperative learning environment. All testing for the course occurs on computer. The music department uses composition software, and plans to expand from one to 10 computers next year. The industrial arts department uses computer controlled lathes.

The Business lab and the IBM word-processing lab each have a digital scanner available for students' use.

The science classroom uses TI-83 graphing calculators, along with several different sensors used to measure things like pH, motion, and temperature. "We can download the CBL's (calculator-based laboratories) right to the computer and into a graphical analysis program and it will print the graphs that the TI-83 displays in a little display window in a nice printed format and also print the data tables into a spreadsheet," says the science teacher.

The biology teacher uses a variety of physiological probes along with the one computer in the classroom when possible. "Unfortunately, I have only one computer in my room, so with 30 and 32 kids in a section, I simply can't have a group of two or three working there and the rest doing something else." This teacher finds CD-ROM technology very helpful in the classroom. "I use the CD-ROM that comes with the biology textbook for a lot of the simulations in the biology classes. Things you can't just look at and understand the concepts – you have to see the motion involved or three-dimensional things."

The family and consumer sciences teacher has three computers with CD-ROM capabilities. "We use them for word processing and independently doing our resumes and such. I've got some programs to do some recipe search, organization, cookbooks, nutrient look-up things, etc."

The ICN room has been on-line since 1992. Students take advantage of a variety of ICN courses from other schools, but no courses have originated from here yet. "We would like to see the ICN expanded," says the principal. "We'd like to see a TV guide of offerings. Scheduling comes out too late to help. We have already scheduled our students for next year."

Impact

Alder High School has a respectable amount of educational technology in place, and ambitious plans to dramatically increase the number of computers next year. Many of the teachers seem to be using technology in the classroom in basic ways, with word processing and internet research.

Some of the teachers feel very frustrated by the technology they have because of a lack of technology support and technology training. The emphasis at this school has been on hardware and software acquisition, and not on training.

The school decided to equip computer labs first, and many of the teachers seem to lack adequate access to the computers in the labs. This problem will be addressed by next year, when there will be a computer on every teacher's desk. The training and support issues will become even more critical at that point if not adequately addressed.

The faculty does not seem to be particularly supportive of each other when it comes to dealing with technology. While they are willing to help each other with the little problems, they don't seem to be learning from each other. "You can't get it (technology assistance) from the guy across the hall who is friendly and tired of helping you, and that's a real sore spot."

The result has been a fractured approach to technology. The technology plan appears to be comprehensive and very positive in terms of what lies ahead for Alder High School. In terms of hardware and software, things do look very good. The problem is that many of the teachers are frustrated by the current lack of access to technology, the lack of training on the technology they might have access to, and the lack of technical support for the technology they currently have.

Critical Factors

The Technology Coordinator is a problem for this school. "I would hesitate to go to (the technology coordinator) simply because I don't know that I would understand what he's trying to convey to me. He's condescending."

In this school, the technology coordinator handles the majority of the training and support for teachers and students. It appears the technology coordinator is a major barrier for the successful integration of technology into the curriculum. A number of teachers expressed concerns about the role of the technology coordinator at Alder High School.

"I feel like I haven't gotten the support that I need. I don't have the time to figure it out myself even though I know that I should. And you don't get any support. If you have a simple question, you don't get assistance."

The technology coordinator "talks over my head. I don't understand what he's talking about most of the time."

A big part of the problem at this school is that it really seems to need a full-time technology coordinator. Teachers need additional technical support. "If there's a problem we can go a long time high and dry before anything gets fixed." "My lab has not been able to print graphics all year. That's a very sore spot. The other lab gets attended to because it's his (the technology coordinator's)."

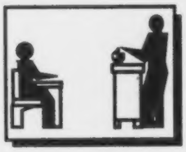
In-service technology training is also a problem. "We're either self-taught or not taught...The Astound program, for example, is something I would love to get into and learn, but I don't know enough about it to learn it on my own, and we don't have inservices for these kinds of things."

"They're trying to get us so we're all working with the computer grade book system, but yet, there are some of us who are supposed to be faculty mentors, but we're pretty much told, 'You've got software on your computer. Here's the book, go figure it out.' We're not given training and we're just going to be sounding boards for the rest of the faculty members."

The availability of technology at Alder High School is a concern. "A barrier would be simply the unavailability of the writing lab when we need it. Or if the lab is available, there are only 13 computers and you have 25 kids. That makes it difficult too."

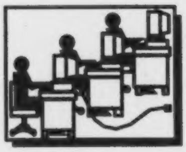
"Having a unit (computer) on your desk makes a big difference. For example, the other day they said there was an important memo that went out on e-mail and wondered, "How come you didn't get it?" Well, I don't have a computer. So what the heck. Tie a note around a rock and throw it at my head. I'd have a better chance of getting it."

Apple High School



Small

Urban



High Tech

Setting

This small town looks like a postcard for Iowa. The highway leading into town has the sort of views depicted by Grant Wood. This is an agricultural community, surrounded by lush farmland. The school sits near the edge of town, a large, modern-looking 2-story brick building. The interior of the building is open and airy, with plenty of natural lighting. The students, teachers and administration are friendly and welcoming. The building is very clean, and feels spacious.

Technology

Apple High School bought its first computer in 1980 - a DecWriter that was used in a computer programming course.

A recent addition to the building showcases a new media center. The center has five research stations with Epsco, electric library, and SIRS. There are 14 other computers available for Internet research and word processing. The media center has an automated card catalog system.

The Macintosh laboratory has 27 computers, all are connected to the Internet. There are three scanners, two quick-take cameras, and five printers in the lab.

There are two business labs. One has 22 Internet-connected computers, as well as 20 electric typewriters. The other has 16 computers, all of which are on the Internet.

The English classroom has 19 Internet-connected computers, used primarily for word processing. This classroom also has a computer with Avid video editing software.

Most classrooms have at least one computer, some have more. The guidance office has two computers, one of which is for student use. The chemistry classroom has two computers used with data probes for gathering and analyzing data. The industrial technology classroom has computers and a plotter.

The ICN room is a receive-only site in its first year of operation. It is used primarily for AEA training, and for a Star Schools curriculum project.
All classrooms have a TV and VCR.

Uses of Technology

Ninety percent of the teachers at Apple High School are using computers in the classroom. The teachers are required to attend technology training.

Many of these students have moved beyond the basics of word processing and Internet searches. A handful of students have been working with digital video editing for a student council project. Students are also doing spreadsheets, PowerPoint presentations, using digital cameras and scanners. The cross-section of students we met with were comfortable with computer technology, and wanted more. They would like more memory for digital editing and creating animations, more sophisticated multimedia machines, and classes that touch on their specialized technology interests.

Despite the wide range of technology available at Apple High School, students say they spend most of their time using word processing software and using the Internet for research. They would like to see a wider variety of technology integrated into the curriculum.

Students would like to have more access to technology. Some find it difficult to find a computer to use during the school day. Most of the students we met with said they do not have a problem with access -- but they also have computers at home and usually prefer to complete assignments outside of school hours.

Impact

The technology plan for this school is very complete, and clearly communicates a vision for the future. A lot of time and energy has gone into planning the technological future for Apple High School, and that effort appears to be paying off. Like most other schools in the state, this school struggles with the financial issues related to technology. The strong planning effort has helped the school make the most of its monetary resources.

The administration at Apple High School plays a very small role in the progress being made with technology integration. The principal is not a technology user, but does encourage the use of technology in education. The teachers are the reason technology integration is occurring at the present rate.

There has been a lot of technology training occurring here over the past three or four years. The school has used Phase 3 money to train teachers on hardware and software basics. The goal is to get all of the faculty comfortable with technology and to increase the integration of the technology into each curricular area.

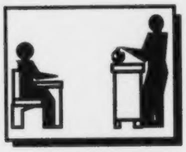
Critical Factors

The teachers at Apple High School are the driving force behind the integration of technology into the curriculum. Turnover rate for teachers is very low. Many of these teachers have been at the school since it began in the 1970s. They know each other well, and know how to work effectively together. "Three of the teachers here are really good", says one student. "Others come in on Saturdays to learn more. There are a wide range of ability levels, but they will find someone to answer the questions if they don't know the answer." One teacher says she is motivated to learn more about technology because she wants to "keep up with students."

There are a number of technology experts on staff because of the school's Resident Expert Program (REP). This program provides specialized training for teachers and students on hardware, software and troubleshooting techniques. These Resident Experts are available to help with technology troubles at any time. The program continues to expand, increasing the number of experts at the school.

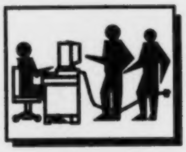
This school enjoys considerable community support in a variety of forms, including cash donations, gifts of used technology, a new addition to the main building, and the recent donation of a manufacturing building in the community. According to the principal, the school has a very good academic reputation, and the community expects that to continue.

Ash High School



Small

Rural 2



Low Tech

Setting

The school is a large brick hodge-podge of a building containing the elementary, junior and senior high schools. The building is very old and has obviously been added on to many times. There are stairs that go nowhere, dead end hallways, and stair stiles between add-ons that must be navigated to move through the building. In the classrooms there are huge windows with full-length shades. The whole school seems naturally lit by windows and skylights. The areas between, lit only by fluorescent tubes suspended from the very high ceilings, seem very dark in comparison. One hall in particular had no lighting whatsoever, it was just a long dark tunnel with a curved arch ceiling that ended in a blaze of light at the industrial arts shop. One gets the feeling that the school's very construction supports the apparent reluctance to adopt change. After years spent in the same building, the students and teachers are well denned-in.

Technology

There is very little technology at Ash High School and what they have is mostly out of date. They have just recently acquired new PCs for their teachers' desks, loaded with Clarisworks, Easygrade Pro, and School Maestro. There is no access to the Internet and they are not, for the most part, loaded with software for students (the exception being the guidance office and the family and consumer science computers.)

There are two computer labs in the school, one is the open computer lab, and the other is the business lab. The open computer lab contains nine Macs, none of which were in use at the time of our visit. The business lab contains 23 PCs, all 286s and 386s, installed with Microsoft Works 2.0. There is also an electronic typewriter available for use. There were seven students in an elective class present at the time of observation. They were all writing papers. In the industrial tech area, there are six PCs to facilitate CAD drafting, a plotter and a scanner. The guidance office has a Mac, which runs "Choices" and "College View". This computer is available all day, provided a student has made an appointment. The band room has a Power Mac, primarily for teacher use. The library has one computer that has the only Internet connection in the school. The library has an automated card catalog, but very few books. In a tiny room off the library are three old Apples shoved onto two desks. The principal's English classroom has one Power Mac and two PCs linked to the business lab. All of the students have their own files, which they can access from the English classroom or the business lab. These three machines are open to students at all times, including before and after school. During class times, a student must have a pass to work in the English room, as long as the class is not already using them. The math room is an island of technology in this small school. There are TI85 graphing calculators for all students, a Mac on the desk, an LCD panel, and a laptop computer. All of the students (8) were working with the TI85s when observed.

Uses of Technology

Word processing is the only widespread use of technology at Ash High. The one Internet connection in the library is reserved for class assignments and is not available before or after school. The graphing calculators are perhaps the second most used technology. Everything else is fairly traditional.

The principal is eager to get the new ICN room that is planned for next year. Further technology plans include using the ICN Internet connection to provide Internet access to every computer in the school, networking all of the computers and upgrading the computers now available.

Impact

There is very limited technology at this school and not many of the students and staff have much personal experience with it. There is a high level of anxiety apparent in discussions about technology. They know they are very far behind other schools, but are ambivalent about jumping into the technology "whirlpool".

The principal is very determined to bring Ash High up-to-date with technology. While the staff is not in open revolt, they are feeling pushed into something that they don't quite know how to handle. They attribute "societal pressure" as a prodding influence to use technology in their classrooms. They worry most about becoming and then keeping current: "Equipment is obsolete when we can afford it." "Once you learn how to use it, they update, you have to update too." "Software is very specific, prices probably won't come down."

The students are also hesitant about technology. Though five of the eight students we spoke with had computers at home, they seemed to find that percentage higher than the student body school-wide. The kids were interested in technology that they perceived as immediately useful to them, but had no ideas beyond word processing and the Internet for research papers and games. They seemed unaware that any other applications could be available to them.

So far there has been very little change in the school because of technology. The computers on the teachers' desks have changed a few minds, though. As one teacher put it: "I thought I'd be real hesitant. I would not go down the hall to learn how to use a computer. Now I have one right on my desk and I'm excited about it. I wish I had more time to work with it." For the most part, though, the teachers are not enthusiastic about the changes from traditional to technological teaching. Some are downright antagonistic, "You'd have to fight me to take away my overhead projector."

Neither the teachers nor the students are satisfied with the current level of technology available to them. The students do not know of other uses beyond word processing and Internet, but still do not feel adequately prepared for the future. When asked if they were prepared to use technology at college and in the workplace, they responded, "not really." Some think technology has no relevance to their lives, "I just want to be a mechanic, so technology is not important to me."

Critical Factors

Ash High has almost no history in technology use. The computers they have were mostly donated by community members and are extremely out of date (except the new teacher computers). The former principal was opposed to technology integration and this is the current principal's first year. There was a technology committee formed in 1996 by members of the community which passed a bond issue to support future technology plans.

The technology plan for Ash High states as its goal, "To have students be aware of the effects of technology and use its related developments." The plan supports the technology required by the business community, rather than any innovative uses.

The principal is the vision holder at this small school. A hometown boy, he attended Ash High himself. After student teaching at a large, technologically advanced high school, he returned home as a teaching principal. Determined to bring the advances he learned of and used in the larger school, he is trying to drag his alma mater into the "21st Century." Realizing how far behind his school is, he is upset at the small amount of funding he has acquired and at how much hardware needs to be obtained before they can even begin teaching teachers how to use it. There are one or two technology advocates on his staff who share and support his vision, but he has a lot of convincing to do with the rest.

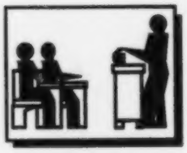
The motivator at this school is societal pressure. The staff feels backward, and overwhelmed at the perceived enormity of the tasks required to bring the school "up-to-date." Because few of them have knowledge or experience with a technology integrated classroom, the pressure to prepare students for the 21st century is more real to them than the new teaching methods that technology can make possible. The teachers fear that technology may make them obsolete, or at the very least threaten the job status of those who are not fluent in the new technologies. The students also hear about the need to be technologically fluent in the next millennium, but they think that it's not relevant to them in their everyday lives.

The attitudes expressed toward technology are jumbled, but are marked with a clear hesitancy. The teachers express a lot of frustration, "It's very exciting for me to see what's out there in terms of computer technology, but it's kind of like taking a starving person to Mister Donut, and letting them put their faces up to the window and say look at what's out there, but you can't have any. We have to have time to learn and to teach. With our number of available computers it's impossible to keep up. We don't even have enough to show anything. Our resources are strained."

Some see it as a waste of money, " I look at the money spent to give us e-mail as opposed to just walking. Is it worth it, given the cost? $20,000 for 30 minutes saved. Is the money warranted?"

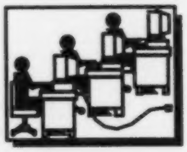
There are those who fear having no control over their students if technology is introduced into the classroom, "Who's going to be responsible if kids get into bad stuff? It concerns me. We can't watch every kid at every machine. The way kids treat that stuff [computers], they aren't responsible with it. I'm concerned because of the cost. If we have a couple of kids that know more than me and they sabotage the computer, I won't know it."

Aspen High School



Medium

Rural 2



High Tech

Setting

Aspen High School is sprawled out on the edge of a small rural Iowa community. The building houses grades K-12, and a new addition is currently underway. The school is surrounded by the usual, a football field, playground, and plenty of parking for the high school students and staff.

The school is a single story brick building. It feels spacious and clean. The staff and students are friendly and welcoming.

Technology

There are four computer labs at Aspen High School, containing a total of 54 computers. One business lab has 19 Pentiums, ten of which have access to the Internet. This lab also has a scanner and two printers. The second business lab has 13 IBMs, one of which has Internet access, and two printers. The Macintosh lab has 10 computers, all connected to the Internet, and two high-speed printers. The PowerMac lab has 12 computers with a scanner and zip drives. All twelve computers have Internet access.

The vocational education classroom has 17 computers. Only the teacher station has Internet access. The classroom also has a television monitor and VCR, as well as a converter to allow the instructor to display the computer screen for the class.

Each of the classrooms has at least one computer. The earth science, English, and home economics classrooms each have two computers. The special education classroom has three computers.

The media center has seven computers and three printers. It also has laser disks, a videotape dubbing system, and an automated checkout system.

The ICN room has been in place for two years. It is used regularly as a place for presentations. There are also students taking a college level psychology course, and there is a calculus course originating from the ICN room daily.

The custodian has a computer which is used to keep track of inventory, and to handle the computerized heating system. The custodian also troubleshoots computer problems for teachers and students.

Uses of Technology

As in most schools, the primary use of technology at Aspen High School is word processing and Internet research. And, like many schools, there are some uses that go beyond the basics.

The vocational education students use computers to explore computer aided drafting (CAD) software.

The music department uses a marching band software, a music writing program, and a Midi electronic keyboard. They use a spreadsheet program to keep track of departmental inventory.

The math classes use TI34 scientific calculators that are available for student checkout.

Earth science students use probes along with computers to gather and analyze data. The instructor creates and presents all lecture notes with ClarisWorks.

The social studies class has a strong multimedia focus. Students are given dozens of project ideas at the beginning of the semester, including: brochure, diorama, photo essay, television commercial, scale model, music video, etc. Students need to show knowledge of the topic, comprehension, application, analysis, synthesis, and evaluation. They are given a list of 20 expectations to guide them through the project, as well as the multimedia evaluation and assessment guidelines that are used by the instructor to grade the project.

Impact

The students at Aspen High School are very technologically savvy. They have access to a wide range of technology tools, and they know how to use those tools. "I have used HTML to create my own web page. I am good at graphic design. I know how to make presentations, brochures, and I do a lot of word processing," said one student when asked how she uses technology at school.

The teachers are doing a good job modeling the use of the technology for students. "The agriculture teacher changed his curriculum to use technology," said one student. "We do searches on line. We get up-to-date quotes and do spreadsheets. This is the only class where you learn to create databases."

The students are given assignments that allow them to experiment with and understand the technology. In turn, they get an excellent opportunity to explore and understand the content. The social studies teacher uses an approach that requires students to pick a topic and a multimedia format for a final project. Not everyone is happy. "I'd rather do a paper because I put so much work into Hyperstudio because it has to look and sound good," said one student.

These students have access to technology, and they are hungry for more. They see the ICN as a rich potential opportunity. "I want more ICN interactions with students from other schools." "We should be more informed about ICN events so we can attend." "We don't get enough opportunities to use the ICN."

Critical Factors

The Aspen High School teachers work well with each other, and learn from each other. This group appears to be very cohesive, and it is clear that technology is one of the things they talk about regularly. "I'd like to do more projects," says one student, "but when one teacher hears what someone else is doing, then they try to do the same thing and we keep doing the same projects over and over."

These teachers know a good idea when they see one. They are willing to use and understand the capabilities of the technology, and they are willing to require their students to do the same. The result appears to be a faculty that works through technology integration problems together, supports each other, and passes the benefits on to the students.

"When you take a look at all the kids' learning styles, you find out that probably 70% of the kids' learning styles are kinesthetic – hands-on, some auditory, some visual," says one teacher. "How you teach about early America – if you do the virtual reality things with kids – I can make history come alive. I mean that was one of the biggest reasons I changed. This is my thirty-second year of teaching so I started a long time ago."

"For years we've taken a great deal of pride in the education of our kids. Our faculty is really pretty good about anything that we can do to give our kids a chance to succeed."

There is a shared vision for technology and community support for that vision. The community contributes money and other resources to help make the vision a reality. The construction occurring at Aspen High is funded by a $3.5 million dollar bond issue passed by the community in October of last year. The funding also pays for a telephone in each classroom, presentation software, more computers and software, and the salary for a full-time technology coordinator. The passage of this bond issue is a strong indication that the Aspen High School community believes technology is critical for continued high educational standards.

"I admire the administration for never really questioning money we spend on technology as long as long as it is within reason," says an Aspen teacher. For the administration, the technology skills of teachers are as important as other teaching skills. "When I go to evaluate them, I do not rank them on their integration of technology," said the principal. "I reinforce it and expect it. This is why we went to block scheduling. It is to help teachers infuse technology. It is expected of them."

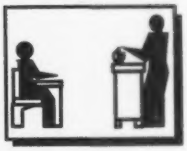
Like teachers everywhere, time is the enemy for the Aspen High staff when it comes to attempts to integrate technology into the curriculum. "Unless there's time to train the teachers who are in the field, I think a lot of technology will go unutilized," says an Aspen High teacher. "There are things available, but so few people have enough hours to really take advantage of them."

The school's superintendent believes the biggest mistake they have made so far is that they "have not set aside enough money and time for teacher training." They have set up a training program where four teachers are paid to teach the other teachers a variety of educational software programs. The Area Education Agency has also provided "great support" to the school in training. In addition, the new technology coordinator will provide additional training support.

"I think until we see teachers using technology more, we aren't going to see them using it more in their teaching. That's just been a slow process because people don't have a lot of time. I think classroom teachers are really loaded down right now," said another teacher.

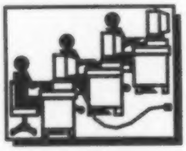
Access to computers appears to be a problem for some students. "We can't get on a computer during school hours. Someone is always on them or a class is in the labs." Three of the five students we met with at Aspen High School said they could not get access to a computer during school hours. One student asked for expanded access to the computer labs later at night. One concern voiced by students is the impact that e-mail has on computer access. "E-mail should be restricted during school hours. Some people are using the computers to send e-mail when I have work to do on the computer."

Basswood High School



Small

Rural 2



High Tech

Setting

Basswood High School is located in rural Northwest Iowa. It is an aging farm community with many retired people who oppose new taxes. The Basswood school district serves four different ethnic groups and has been designated by the federal government as an economically disadvantaged area.

This small district is housed in a single building that serves grades K-12. There are 93 students in the high school.

Technology

Basswood Community School has approximately 70 computers. About half of them are newer Macintosh computers and the rest are older Macs, with a number of Mac Classics. Nearly all of the computers are networked and the school has two dial-up Internet access phone lines.

The school also has a few graphing calculators, a Flex cam for use with microscopes, a robotic arm, a scanner, a plotter, and several printers.

Students and staff have access to email accounts and each has a network storage area for personal files. The Internet use policy warns "Users should not expect that files stored on district servers will always be private."

The original technology plan called for the installation of an ICN room, but this was rejected by the School Board. The principal would still like to find a way to obtain one.

Technology Use

The principle use of technology at Basswood High School is for word processing and Internet research. There is some use of spreadsheets and graphing calculators in specific classes, but this is not wide-spread.

Impact

Teachers and students report that using technology is motivating for them. "This makes it more fun to learn." They also appreciate having access to greater amounts of current, relevant information for class use and assignments. "We are a small school, so we need more resources."

Critical Factors

Basswood High School has a principal who is technologically savvy. He helped to wire the school and encourages teachers to integrate technology into their curricula. He is hampered by a lack of community support which is reflected in the failure of bond issues for technology.

Teachers have identified a need for more training in how to integrate technology into the curriculum. As one teacher said, "The newness of the Internet has worn off." The Basswood technology plan calls for regular teacher in-services, but allows only an hour or two for each session. The principal describes AEA support as "Excellent. We get about anything we want."

Basswood High School also needs more information about what is possible with technology. The technology plan identifies student learning outcome goals and identifies technology as a means of achieving them. The plan is not specific about how to do this. For the need to improve student communication skills, the action steps are "assess the current use of technology in the writing process and make recommendations to the school board." The implication is that just using technology in the writing process will improve communication skills.

Beech High School

Large

Rural 2

Low Tech

Setting

One lane traffic in a mile long construction zone set the tone for the visit to Beech High School, a large, modern, single-story building nestled among a mixture of small businesses, cozy cabins and small residences. This historic community was built around the winding roads that surround one of Iowa's largest lakes. Although set in the middle of acres of productive farmland, this community's economy is based mostly on tourist traffic six to eight months of the year.

The cleanliness and bright, modern appearance of the school might have been surprising to one familiar with the area's colorful history. The school's classrooms reminded one of a moderately-priced ranch home neighboring more expensive, glass-fronted lake homes and well-manicured yards on one side and small, wood cabins on another.

Technology

We were first introduced to the technology director in the media center, who explained her expertise was in curriculum. "Technology is integrated better at the lower levels," she explained. "Resources are spread thin at the high school level." For example while the elementary is fitted with Macintoshes and the middle schools have DOS computers, the high school has a blend. However, the ICN room in the school district is located in the high school. While the school installed the ICN room three years ago as part of the Phase III remodeling, the technology director said the ICN room is not used enough.

The spacious open media center displayed books and study tables with computers lining about one third of the outside walls. Separated from the media center by a wall were two computer labs with 15-20 computers each. In order to control the use of the Internet, the technology director admitted, access is only on the teacher's computer in each classroom and in the media center. She reflected the school administrator's concerns, which questions whether or not "student email is a productive use of student time."

While most teachers at the high school have worked at least 20 years, "some teachers integrate technology and learn with the students and some won't," she explained, adding that the science area is the weakest in the use of technology.

A local firm has assisted the school with upgrading and working within the preexisting infrastructure. A local bank has developed a partnership with the school, exchanging financial support for opportunities for students to develop web pages for the bank. However, more community support is needed. To change the community's perception of the school as a low technology school, students have been encouraged to develop a technology showcase to inform the community of what technology can do. The school's tax base consists of many non-resident property owners who do not wish to see taxes raised.

Uses of Technology

The principal of Beech High School stated that the district's technology plan increased the use of technology in the school and he expects even bigger changes in the next 12 months. "It comes down to finances," he said.

While the principal considers technology to be a good tool for teachers, and teachers are encouraged to look at new things and try new things, staff development is not a high priority at Beech High School. Nor has the district relied on support from the AEA.

Impact

The principal mentioned how technology is used in the Teaching Center Resource Room with Special Education students. "They are able to do their assignments. It takes them further in different areas and they have a better understanding of what they are learning."

"Teachers don't use something if they are not comfortable with it," one teacher said. Most agreed they needed more staff development, but they also needed more technology. "The average business spends 30 percent on their technology budget. The average school spends three percent," said one teacher. Another said: "Business and industry can make changes more quickly. Education takes 10 years to make changes."

Comments were mixed among teachers discussing the value of using technology and change in student learning. "Technology makes them lazy," and they need to learn problem solving skills. Another complained that students "have given up reasoning of math," and "students become machine dependent." Others said that students "do more than they thought they could," with technology. "Without technology, the pride wasn't there. They can be more creative and try different things."

It was apparent that the students selected by the administration for the focus group were not the typical students at Beech High. Of the eight students, all but one were seniors. Of the seniors, all but two were male. Of the males, at least two were participants in BEST, a group of students working within the local bank/school partnership. The others indicated they were part of the group of students that "teach the teachers" how to use technology. The two senior females were less vocal about their expertise or level of use of technology.

These students indicated they used technology at school for research, papers (word processing), desktop publishing, school-related research on Internet, e-mail, photo editing, graphics, programming, and Web page development using Front Page. Students mentioned using computers to make posters, spreadsheets, band music, multimedia and PowerPoint presentations and collecting data for chemistry labs. One student indicated he used the Internet every period of the day. Another said he had a Spanish class in the ICN room for a day or two.

Students complained that the ICN was used very little, and used mostly for college classes. The ICN was displayed to the community during the technology showcase. Commented one student: "There is not much interaction going on. We see projects being done between schools around the state," however, Beech High School does not use the ICN in their own learning. Some students argued they need to learn how to "be effective over a distance," as they enter the world of work. Using the ICN will be helpful." said another student. "When you get in the business market, you use video conferences."

Students indicated that technology did indeed change they way they learn. "We do lab programs on the computer, and we write it up right there," offered one student. While teachers won't allow students to use only Internet references, student research papers often have 10 to 14 sources, explained another student. In addition, students said research topics are diverse and broader because of the Internet.

Others explained that at first teachers required them to write on paper and then transfer the document to the computer. However "now we put it in the computer directly." Another replied: "It is dumb to do it on paper. All students are required to take word processing. Drafting and composition are done on the computer. Advanced accounting is doing some. Some who took word processing (as freshmen) have not done anything since."

Students agreed also that technology has changed what they learn. "We learn a lot more using technology rather than using teachers. We are able to hear all sides of an issue, get different perspectives." Another said: "Teachers are no longer the ideal source. They can sit and smile in the back of the classroom."

While students believe that technology has changed the way they learn and what they learn, they do not feel as strongly about technology's effect on how and what teachers teach. "I don't think it's changed the curriculum much. They might find something different (on the Internet) the night before," said one student.

Students warned that teachers also need to look at the source, before they present something new in class. "They need to use common sense," said a student. Another added: "Technology can hamper the way a teacher thinks. It could be false information."

Students were generally critical of teachers and their lack of training in the use and integration of technology into the curriculum; however, one student helped others to see the other side of the story by questioning: "Will our kids think their 80-year-old grandparents are hopeless?

Most students were positive about using technology in learning: "I work with technology. It is fun. It's never a dead end; always a through street, with programs and new products." While one student complained that computers still have lots of technical problems, which causes students to waste time, another student replied: "That's your mistake." In other words, students need to be responsible for learning how to use technology. One student added that "70 to 80 percent of students don't know what's going on. Ten to 15 percent are dumbfounded."

When students were asked how they rate their school for technology use, two students answered: "Better than most, in general. You can gain knowledge yourself.

Everyone in school knows that. There is value in peer help." Another said: "We learn to rely on each other. That is more what college is like. We are not intimidated, we are excited."

Critical Factors

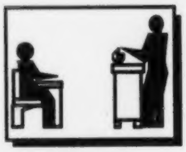
Who is pushing the use of technology in Beech High School? Say students: "It is the student's desire. There is no one to push you. In the BEST group, we push each other. It has changed the way I think. Instead of asking, we do it. We don't have someone to teach it to us," said one avid technology user. Others agreed: "You become dependent on yourself."

Students complained that all of the computers for students are located in the media center, although some students use the computer on the teacher's desk. One suggested: "We need to bring a computer (for student use) into every classroom." Some said most students needed a general overall class in computer usage. Furthermore, "we need someone who can teach it. We are not utilizing it to the full extent. Instructors don't know. Most of us have taught ourselves. We teach the teachers."

One student said: "We need to get teachers updated. "One student suggested the problem was teacher apathy. This brought out several replies like: "A lot of teachers try," and "What did you expect? They don't know how to use technology." One student disapproved of the need for students to teach other students how to use technology. "Teachers should be teaching school," the student said.

Another student who served on the technology committee explained that "Dealing with money is tough. There is not enough money given to the training of teachers. With the upcoming technology, you will just have to teach yourself. This student became very vocal as students answered questions about how technology was integrated into the curriculum. "Integration is a gross misnomer. We do not implement technology," he said. Another student agreed: "We don't get a chance to use it."

Birch High School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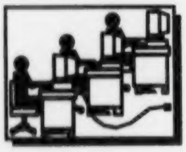

High Tech

Setting

We had been on the road since before dawn. As we neared our destination, the roads, that had progressively narrowed, neatly divided the flat landscape into fields anxiously awaiting the farming activities that heighten with the changing season. On the horizon, a grove of trees pierced by towering grain elevators welcomed us. This small, well-maintained community would be our host for the day.

Though we had good directions, the school would have been difficult to miss in this town of two main thoroughfares and a handful of cross streets. We turned off the main road and passed a trim residential block before entering a small parking area surrounding a flagpole in front of Birch High School. From the outside, the building was very typical of many older high schools scattered around the state. This was one of four buildings in this district which serves two communities. The middle school is located in the other community and each community has it's own elementary school.

The interior was surprisingly bright. The hallways were bright and well lit with colorful murals and motivational sayings painted on the walls. An addition included a common area used before and after school as well as for study hall. Classrooms had been remodeled with lowered ceilings and new windows. The Birch High School mission accompanied by positive sayings and mottoes were posted in many of the rooms. It felt warm and welcoming. The students and teachers that we observed seemed content and comfortable in the building and with each other. It was a nice place to be.

There was an atmosphere of trust and respect. An example of this is in Birch High School's Internet policy. Students have to obtain parental permission to get an Internet license. However, there are no restrictions in use. As the technology coordinator put it, the policy is "based on trust and responsibility". Though there have been a few problems with inappropriate use, they have been minor. Email is viewed as a privilege that must be earned. Currently it is extended only to seniors, but this is being reviewed and email addresses may be provided to juniors next year.

The principal characterized the community as very conservative with traditional values of home, school, and church. From all appearances the community seemed to take pride in its school. Additions had been made as needed and rooms updated. The community has been supportive in funding instructional levies and assisting with updating the computer lab. As the principal indicated the "community supports the school in preparing kids for the future".

Technology

From a review of the State Department of Education technology survey, this district was identified as a high technology district. What we observed in Birch High School supported this. Two networked computer labs with Internet access supported regular classroom activities and computer classes. Each lab had 24 computers for student use with five printers. The teacher workstation in each lab had a computer and an LCD panel. One lab included a scanner and a CD tower. The other lab was set up for foreign languages with headphones at each station.

All classrooms were equipped with a computer, a printer and an overhead projector. Some of the computers were quite capable of handling today's applications.

However, about 30% were only able to handle word-processing at a very basic level. Two classrooms with Internet access connected the computer to a TV and plans are to expand the number of classrooms with this capability. Wiring is in place for all classroom computers to be networked and this will be completed as new computers are purchased to replace outdated models.

The agriculture and industrial technology classrooms each had two computers. One computer was connected to a milling machine. Funding for a portion of these came from the Carl Perkins fund. There were four computers in the business classroom.

The media center had seven workstations with Internet access. These were connected to two printers. In addition, there were two computers dedicated to the on-line catalog, one used primarily for checking in/out materials, and one for the media specialist.

Administrative offices were supported with computers. Both district and building offices had desktops, printers, and laptops for administrative uses. Guidance and counseling had two computers to assist students with career choices and one computer was located in the teacher's lounge.

An ICN classroom has been in place for about a year and a half. This has not been used much for high school classes or activities but is being used for community college classes and community training needs.

Uses of Technology

Most teachers are using traditional types of technology. Videotapes and the use of the overhead projector for presentation dominate. Typical uses of the computer center on tool software with word-processing receiving the highest use.

Administrators, support staff and guidance counselors are using the computer for scheduling. A couple of different student data management packages are being explored, but none are in use at this time. Counselors are also using computer software for career exploration.

Teachers use the computer mostly as a management tool. They create worksheets, tests, and some keep their grade books on the computer. A foreign language teacher indicated the use of software for languages and drill and practice. Most teachers indicated that they are either unaware of the possibilities or lack the time to develop the skills necessary to do more innovative things with the computer.

Students were excited about email. They also liked being able to use the automated card catalog. Most used the computer for word processing and the ones that were using the Internet for classes were mostly doing research with little or no guidance.

One teacher was enthusiastic about the computer set-up in her room. The computer was connected to the TV and this allowed her to do a couple of different things. Because this classroom had Internet access, she could show a variety of sites to her classes. Without really thinking about it, she was modeling appropriate uses for the Internet and teaching the students to be educated consumers of Internet resources. She also taught a broadcast media class, and used this set-up as a teleprompter.

The principal was excited about using recently purchased CD ROM's and interactive web sites to create an educational lab for at-risk students. He saw this as a way to create an alternative school right in the same facility. He felt this was a more exciting option than individual courses.

Impact

Teachers at Birch High School were realistic in what they viewed as the impact of technology. They recognized that the "access to information is nonending" and that the use of technology "opens more doors for students". Textbooks become outdated but current information is readily available. An English teacher indicated that the use of the computer "frees us in the writing process to concentrate on the creative process and not so much on the mechanics". We "require students to print document information with it, technology allows us to be accurate, have kids do more because they can do it faster."

Teachers also recognize that this brings with it a need for a new set of skills both for them and for their students. "Students are not afraid, but not knowledgeable. They don't want to read to learn, [they] need to develop organizational skills, procedures, discipline." "As a teacher, we have to teach them what junk is." However, "you have to stay ahead of kids and that's tough. It is mind boggling, someone has to give you the initial push."

Some students indicated that they felt they were learning more. Teachers were "expanding on topics covered in the text by having (students) prepare presentations for class on information that is not in the text". One student provided an example of how Internet use by a teacher was providing them with a global perspective. "We were studying Islam, so we look at Islamic homepages, and went to museums for virtual tours."

A couple of students felt that "kids got involved more" when teachers used the technology. They preferred "web pages over lecture". However as one student said using web pages is not necessarily better just different.

The principal seemed to feel that the use of technology changed the whole learning process. "It is changing how we teach and could change our role to coordinator and facilitator instead of a teacher." "Students can work at their own pace, search for information, and get immediate feedback."

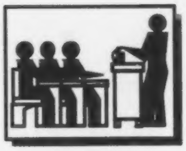
Critical Factors

Factors affecting the integration of technology at Birch High School include administrative support, community support, and a technology plan. Both the principal and the superintendent indicated they did not feel highly skilled in technology. However, they both recognized the important contributions of technology to both teaching and learning.

The community firmly supports the educational efforts of Birch High School. They are behind it all the way. Evidence of this support is through active involvement in technology planning and funding.

Birch High School has a technology plan that goes beyond simply identifying hardware needs. They are beginning to recognize the connections between hardware purchases, software, and curriculum.

Box Elder High School


Large

Rural 2

Low Tech

Setting

We were in the area visiting another school, so we spent the night in Box Elder . This was a nice size community. Though the grain elevators dominated the skyline, the downtown area seemed to support a large variety of businesses. In addition, a community college was located just at the edge of town.

We had expected nice weather for our visit, but you could certainly tell we were in Iowa as we headed to the high school in the middle of a snowstorm. We thought this would let up, but it continued throughout the day. In fact, we ended up changing our meeting with teachers so we could get on the road while there was still daylight. This meant that the teachers we met with were selected by virtue of having a free class period at the right time.

Box Elder High School was located at the edge of town on a large section of land to allow for future development. It had been built in the late 1960s with several areas designed with open classrooms. Over the years, teachers have added "walls" to their classrooms using bookcases and other storage cabinets. A large central area served as both study hall and lunch room.

When we arrived, we went to the office to meet the principal. However, an emergency had come up and the principal was busy so we sat down to wait. This gave us the opportunity to observe students coming and going and visit with the secretaries. While all attempted to make us feel welcomed, they seemed unsure of why we were there.

When we finally met the principal, you could tell that we really had not picked a good day to visit. He had planned on visiting with us and then taking us on a tour but it was obvious his mind was on other things.

The atmosphere was hard to judge. For the most part, I think the weather was affecting students' behaviors and teachers' reactions. If we had been there another day, I think we would have gotten a truer idea of what this school is really like.

Technology

On our tour, we had the opportunity to observe the current level of technology available and in use. Our first stop was the media center. The name conflicted with what we observed. They did not have an automated catalog system in place. There were no computers available for students to access databases or the Internet for research purposes. They did have a FOTS room for the ICN (but no classroom) and a storage area for a variety of media equipment including overheads, VCRs, and TVs.

All classrooms are equipped with monitors because the school is receiving Channel One. In addition, all teachers had access to a computer though few had memory or speed capabilities to access the Internet or do much more than simple word-processing. About half of the classrooms had Internet access but not all of these had a computer available to actually access the Internet.

The business classroom had 22 computers. These were predominately used for word-processing. The principal mentioned that they would like to free these computers for other uses by moving the computers out of this classroom and replacing them with DreamWriters. None of the computers were in use when we visited.

The computer lab had 20 computers with Internet access. This lab is usually in use by computer classes and students coming in from study hall. It is difficult to schedule a time to bring a class to the lab to integrate computers into various content areas. When we were there, study hall students were sending and receiving email to classmates in the same room.

Students in a math class were using graphing calculators. However, the day we visited students were not using the graphing functions.

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In summary, for the number of students at Box Elder High School, there was surprisingly little technology. What was present, was being used to the maximum.

Uses of Technology

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Critical Factors

One factor that has greatly influenced where Box Elder High School is in relationship to technology is the lack of vision. We heard this repeatedly from both the principal and teachers. When asked about the technology plan the principal said, "We've had no plan. We have taken a piecemeal approach. It infuriates me that we didn't put it together with a vision!"

Another factor has been the lack of leadership. This district has no technology coordinator and until recently, administration was not really supporting the use or acquisition of technology. "We need leadership." This should change as there is a new superintendent with "a wealth of technology knowledge" and plans are in place to hire a technology coordinator.

A third factor is the lack of collaboration among faculty, administration and the community. From comments, you get the feeling that they don't communicate with each other. Faculty members feel left out and also indicated that education is getting a lot of "bad press". All this contributes to an atmosphere where decision making is difficult.

Table 21. Percentage of responses via the WWW

	Participants		Random Sample		
	number	percent	number	percent	note
Total surveys	385		399		1
Web responses	117	39.9%	16	9.9%	2
Mail responses	176	60.1%	145	89.5%	3
Total responses	293	76.1%	162	40.6%	4
Prefer web response	150	51.2%	48	29.6%	5

Notes

1 Due to attrition, 385 participants remain from the original 400 participants.
399 Randomly selected Iowa teachers were mailed surveys.

2 Web responses as a percentage of total responses.

3 Mail responses as a percentage of total responses

4 Total responses as of 2/15/99

5 Includes those who used the web and those who said theu would prefer to us
but didn't have a chance to do so.

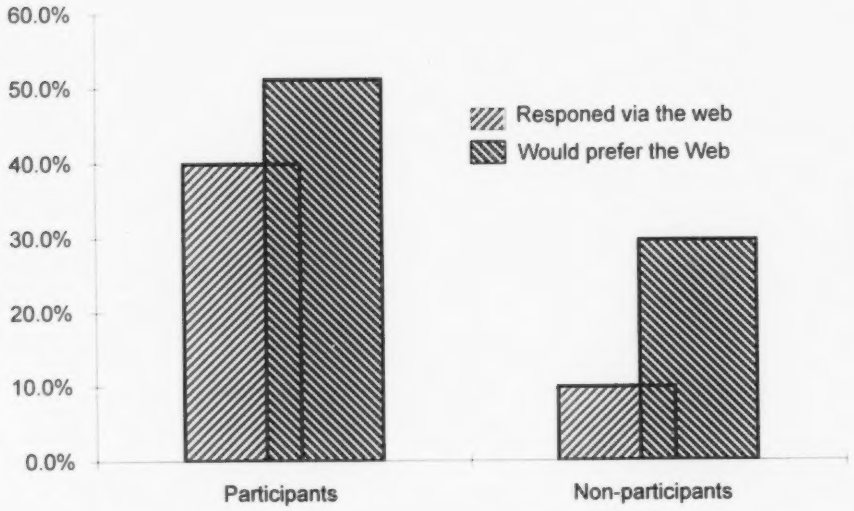
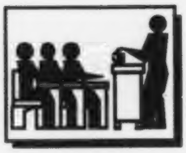


Figure 17. Percentage of survey responses received via the WWW.

Box Elder High School



Large

Rural 2

Low Tech

Setting

We were in the area visiting another school, so we spent the night in Box Elder . This was a nice size community. Though the grain elevators dominated the skyline, the downtown area seemed to support a large variety of businesses. In addition, a community college was located just at the edge of town.

We had expected nice weather for our visit, but you could certainly tell we were in Iowa as we headed to the high school in the middle of a snowstorm. We thought this would let up, but it continued throughout the day. In fact, we ended up changing our meeting with teachers so we could get on the road while there was still daylight. This meant that the teachers we met with were selected by virtue of having a free class period at the right time.

Box Elder High School was located at the edge of town on a large section of land to allow for future development. It had been built in the late 1960s with several areas designed with open classrooms. Over the years, teachers have added "walls" to their classrooms using bookcases and other storage cabinets. A large central area served as both study hall and lunch room.

When we arrived, we went to the office to meet the principal. However, an emergency had come up and the principal was busy so we sat down to wait. This gave us the opportunity to observe students coming and going and visit with the secretaries. While all attempted to make us feel welcomed, they seemed unsure of why we were there.

When we finally met the principal, you could tell that we really had not picked a good day to visit. He had planned on visiting with us and then taking us on a tour but it was obvious his mind was on other things.

The atmosphere was hard to judge. For the most part, I think the weather was affecting students' behaviors and teachers' reactions. If we had been there another day, I think we would have gotten a truer idea of what this school is really like.

Technology

On our tour, we had the opportunity to observe the current level of technology available and in use. Our first stop was the media center. The name conflicted with what we observed. They did not have an automated catalog system in place. There were no computers available for students to access databases or the Internet for research purposes. They did have a FOTS room for the ICN (but no classroom) and a storage area for a variety of media equipment including overheads, VCRs, and TVs.

All classrooms are equipped with monitors because the school is receiving Channel One. In addition, all teachers had access to a computer though few had memory or speed capabilities to access the Internet or do much more than simple word-processing. About half of the classrooms had Internet access but not all of these had a computer available to actually access the Internet.

The business classroom had 22 computers. These were predominately used for word-processing. The principal mentioned that they would like to free these computers for other uses by moving the computers out of this classroom and replacing them with DreamWriters. None of the computers were in use when we visited.

The computer lab had 20 computers with Internet access. This lab is usually in use by computer classes and students coming in from study hall. It is difficult to schedule a time to bring a class to the lab to integrate computers into various content areas. When we were there, study hall students were sending and receiving email to classmates in the same room.

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Butternut High School

Medium Rural 2 Low Tech

Setting

We had a clear, though somewhat icy, day to travel through the rural countryside to this small community. Following the school zone signs led us to the combination elementary/middle school and district office where we stopped for directions. It was of interest to note that the high school principal was there trying to locate a copy of the district technology plan. The office staff was helpful and we were soon on our way through a residential section to the edge of town where the high school was located. The high school is almost 30 years old but from the outside it appeared to be well maintained.

Because of the icy walks, we entered Butternut High School through the nearest door that led us to a dark hallway. No students were around, but this may have been because they were in class. We wandered around until we found the office. Here we found both staff and students to be very friendly and helpful. Throughout our visit, we noticed an overall positive atmosphere. Hallways never seemed overly crowded and overall noise levels were low. What was really impressive was the apparent rapport among faculty and students. They seemed to genuinely like and care about each other.

Technology

Attitudes toward technology use at Butternut High School were evident before we even met with the principal, teachers or students. Signs identified the computer lab was closed and indicated severe restrictions on Internet and email use. It appeared that computer access was used as part of a reward/punishment system where privileges were denied for a variety of reasons including overdue books or absences. On further inquiry, we found the computer lab was closed to all students because one individual had mistreated an overhead projector.

Butternut High School did not have a full time technology coordinator. As in many schools, the computer teacher had been assigned this additional duty. Two technology plans seem to exist. The "official" one was written by the superintendent. The other technology plan had been developed by the technology coordinator and seemed to have greater support from the faculty.

This is the first year that Butternut High School has had Internet access. They seem to be struggling with how to manage this. All classrooms are wired but there is no equipment with which to access it except in rare cases. The computer lab has access, but there is no one to supervise students so the lab is closed frequently. Until recently, students received their email by picking up printed copies in the media center office.

The district has an ICN classroom, but this is located at the middle school. Though this is only five or six block away, it has caused much controversy. In something of a boycott, both teachers and students are refusing to use it. They feel it should have been located at the high school to maximize ease of use.

The computer lab had about 20 computers. Though it was previously stated that it had Internet access, this is a little misleading. At the most, only half of the computers in the lab would be capable of accessing the Internet. It was a real mix of old with a few new computers. Many would be capable of only doing the most basic word processing. Just one student was in the lab when we visited.

The media center was better equipped. It had its own server and CD-ROM tower, four permanent work stations and two more on carts. All the computers in the media center were in use.

Our tour indicated that the vocational agriculture education program was well advanced technologically. Because of the well-planned use of Carl Perkins money, they were well equipped with computers and Internet access. Because of this access, the vocational agriculture teachers were far ahead of other teachers in the building in the integration of technology.

Overall, what we observed on our visit supported our identification of Butternut High School as a low technology school.

Uses of Technology

Due to limited access, technology use by teachers and students at Butternut High School was very low. A few teachers were requiring students to use the Internet for research. Many teachers indicated they used their personal computers for managing grades and creating worksheets and other classroom materials. All indicated their frustration with the lack of access and their desire to do more.

Administrative use of technology was high. Administrative offices were well equipped with computer technology. Student records were being maintained on the computer and all class scheduling was done on the computer.

Impact

Technology has had little impact on Butternut High School due to the lack of technology. All are aware that they are "missing out" on something though teachers indicate that they are "not even sure what is possible". They indicated that they believe they should be providing opportunities for their students to use technology.

They want access in their classrooms and they want a full time technology coordinator to provide guidance and assistance.

Teachers were very vocal about the need for technology. In many ways they felt shut out. They had not been asked for their input in the technology plan and they had not been consulted in the decision to put the ICN classroom at the middle school. Both of these oversights have contributed to a staff which perceives itself as not being supported or respected by the administration at least in reference to technology.

Critical Factors

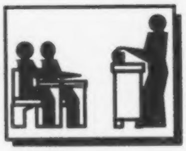
Factors which have contributed to the current state of technology at Butternut High School include the level of communication between faculty and administration, technology leadership, and the current state of change.

It would seem that while there have been many opportunities for faculty and administration to talk with each other, neither side is really listening. Faculty members indicated that they did not feel they had been offered a chance for input in technology planning. And even if the opportunity for input did present itself, teachers didn't feel that their ideas were valued. On the other side, administrators did not feel that teachers were interested in providing input and cited the lack of attendance at special meetings as evidence.

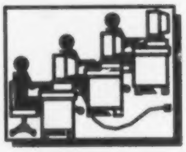
Butternut High School lacks a real technology vision holder. While the technology coordinator may have the skills and the vision, his current teaching load prevents him from being able to provide leadership in this area. Other administrators attempting to provide technology leadership do not appear to be overly enthusiastic about the educational uses of technology.

Butternut High School is in some turmoil due to recent changes in scheduling. A major effort has been spent in reorganizing both the high school and middle school. Part of the negativity we heard from faculty and students related to technology is in part a carryover of reactions to this other major change and the way it was handled.

Catalpa High School


Medium

Rural 2


High Tech

Setting

Catalpa High School sits on the edge of a rural Iowa community. About two-thirds of the students are from this community, while another third come from the rural areas surrounding the community. Many of the town's residents drive to a larger community nearby to work.

The principal tells us there are a high number of unemployed and single parent families in the community. He says he spends a large portion of his day handling discipline problems and has little time to worry about technology. In the past eight school days he had placed six of the 175 students in the high school on suspension.

The school is a sprawling single-story brick building. The front entrance leads to a large open commons area, with administrative offices off to the left, the library on the right, and the cafeteria/study hall area just beyond the commons. The classrooms have large windows, with a lot of natural light. The school appears bright and clean.

Technology

Catalpa High School has 92 computers. Three are servers, and 89 are usable by students, staff, and administration.

There were two computer labs at Catalpa High School, the smaller one had six computers (only five work), all were connected to the network. The larger computer lab had 25 computers, all of which were networked and had Internet access.

Every classroom had at least one computer and a printer. Not all the computers are used regularly. Many of the computers in the classrooms are used exclusively by the teacher for classroom management purposes.

Some of the classrooms have more than one computer, making it easier for the teacher to integrate the technology into the curriculum. The journalism classroom has six computers, the language arts classroom has three computers, and vocational agriculture has two computers. The life skills classroom has two computers, the resource room has two, the library has four computers and a typewriter.

The industrial technology classroom uses 12 computers for a modular exploratory technology program. The modules include: satellite communication, radio broadcasting, exploratory electronics, computers and computer servicing, computer numerical control (milling and turning), CO2 raceway, mechanical power, aerodynamics, fluid power, automation and robotics, and environmental technology.

The art classroom had nine Macintosh computers, a color laser printer, two desk jet color printers, a digital scanner, and zip drives on all of the computers.

The kitchen has a computer that is used to scale recipes and manage both inventory and a recipe collection.

All classrooms have a television monitor and VCR.

The school has an ICN room that has been up and running since the winter break.

Uses of Technology

At the time we walked through the school to look at the available technology, we found the majority of students who were using computers in the computer labs were playing games or checking their email.

Most of the teachers appear to be using technology in one way or another, typically as a classroom management tool, for word processing or for Internet research.

There are pockets of more innovative use throughout the school. The classrooms that are using technology most extensively are typically headed by a teacher who has more extensive computer knowledge.

Impact

This school has plenty of technology available, but it seems to be under-utilized by the students. The students who were using the computer labs during our visit were mostly playing games or checking their email.

Students tell us they want more access to technology. They need to get a pass to go to the computer lab during the school day. If there are more students than computers when a class visits the lab, some students need to make up the work outside of class time. One student said she was frustrated by the fact that the ICN room is not used more often.

Students also tell us that the reason the technology they have is not utilized more is because they don't know how to use it. "We've got the technology, but you don't learn about it unless you figure it out on your own."

The school has a new superintendent in place and a new principal. The teachers tell us the principal has been there for less than a year, and has already been asked by the school board to resign. There is very little communication between the teachers and the principal, and very little respect for him from either the teachers or the students.

The principal says he supports technology use, but doesn't model technology use. He says the technology plan is a critical component for the school, yet he did not recognize the technology plan when it was faxed to him from the district administrative offices. He did not know if a strategic plan for his school existed, although he had already given us a copy of it.

The previous administration was very pro-technology, and had a vision for the future of technology at Catalpa High School. The teachers are very concerned about the future of technology here for a number of reasons: the apparent lack of technology vision, the loss of their technology coordinator at the end of this school year, and the loss of funding for technology because their sharing incentive money runs out this year.

The teachers seem to find technology frustrating. The network has been in place for a year-and-a-half, and has been problematic since the beginning.

Critical Factors

The principal of Catalpa High School started his job the previous summer. So did the superintendent. A critical administrative change like this is certain to have an impact. The teachers tell us the previous administration had a well-articulated vision for technology. They do not seem to think the current administration has a technology vision. The fact that the principal did not have a copy of the technology plan, and did not recognize it when it was faxed to him indicates a lack of participation in the process of developing or carrying through the articulated vision.

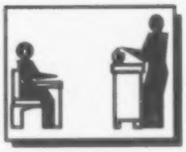
The technology coordinator has worked at this school part-time for less than a year. His background is as a networking expert, and he has no education background. He is at Catalpa High School two days a week, and works at another nearby school the rest of the week. Next year he will be working at the other school full-time, and Catalpa High School will need to find a new technology coordinator.

The technology coordinator appears to be very competent with the challenging networking problems this school has faced. He has focused on network servers as a way to bring content to classrooms throughout the school.

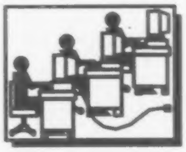
His weakness appears to be in teaching the teachers how to use the technology. Most of the teachers say they have adequate hardware and software, but they do not have the training in how to use what they have. Other than the AEA, there does not appear to be a readily available source of information on technology integration for the Catalpa teachers.

The students are hungry for more information on how to use the Internet more efficiently. "I use the Internet but it is hard to find information. I don't know how to search."

Cedar High School


Small

Rural 2


High Tech

Setting

The Cedar School District serves two small towns in the state. The elementary school and the middle school are in one town and the high school is in the other. The high school principal also serves as the elementary school principal.

The day we visited this school their schedule had been delayed two hours due to freezing rain. The researchers were also delayed due to freezing rain and the principal told us he would rearrange his schedule so that we could collect needed data. When we arrived, the principal determined that there was not enough time before lunch for us to interview him and agreed to allow us to come to the elementary school in the afternoon for this purpose. When we arrived at the elementary school, he chatted with us for 20 minutes until the technology support person (not a teacher) was available. Then he escorted us to the technology support person and told us to interview her. We requested that he stay as well and he complied.

Cedar High School is composed of a number of buildings that were built separately and then joined when the school needed more space. The result is a maze of corridors and stairways that connect the two- and three-story buildings. When we toured the building, our guide made a point of marching us up and down each flight of stairs in the building even though this was not required as the school is connected on the second floor.

The walking tour took place at the beginning of lunch hour so there were few classes available for observation. Lunch was served in two sittings. During the first seating, only girls were in the cafeteria. During the second, only boys were visible.

Both researchers felt very uncomfortable at this school, as if we were being shut out somehow. Rather than eating our lunch at the school, we visited the café in town. This café seemed to be the social center of the town with "regulars" who took their lunch at the café daily and chatted freely with the waitresses and each other. Here we met Mel (a customer) and two waitresses. Mel had dropped in for some pumpkin pie a la mode and a little conversation. He told us that he has a computer that he bought three years ago to help him at work, but he doesn't use it because he hasn't figured out how to make it work. The waitress advised Mel to get his grandchildren to help him because "they know how to do all that stuff."

One of the waitresses, Kathy, is married to an Industrial Arts teacher at the high school. She said he has tried to pick up some of the "...computer stuff, but it's harder for older folks to do."

Technology

During the 1996-97 school year Cedar High School hooked up an ICN room, put a computer on each teacher's desk, networked the high school building and provided access to the Internet in every high school classroom. The teachers were partners in this effort as they purchased the computers that were put on their desks. The purchase agreement requires the computer to be available at school during the day for student use for three years.

In addition, the school has two computer labs. One lab contains 18 computers with Internet access, the other contains 19 computers with Internet access. The labs are used for computer classes that all students are required to take. During all periods students are allowed entrance to the labs on a space available basis.

The media center has two computers available for student use. Both are connected to the Internet. At the time of the tour, a group of three students was clustered around a single computer accessing the Internet.

The ICN room has been in use for two years and is currently used to offer a Nurses Aid course to students at the high school. Students say this makes it easier to obtain this certification.

The school purchased an administration package that includes attendance, scheduling, and grade book software. All teachers use the attendance program and some reported using the grade book.

The Industrial Arts classroom contains 14 computers which are used to teach a CAD class. They also have a photography darkroom, a scanner, a TV, a VCR, a camcorder and a cassette player.

The art classroom has a scanner as well as a digital camera. However, the computer in the art room lacks sufficient RAM to be able to use all the software and peripherals needed by students.

Uses of Technology

The typical level of technology use at Cedar High School is for word processing and Internet access. The Industrial Arts department is an island of advanced technology including robotics, animation and computer aided drafting, but this department is being reduced in size and the advanced courses will no longer be offered.

Impact

Although technology seems readily available at Cedar High School, it seems to have made little impact on the students or teachers. When asked, students report, "When looking for information for reports we use the Internet now." "(We) don't have to write papers out by hand any more." "Technology makes things a lot easier, like typing papers." "I'm very thankful for SpellCheck." One student offered, "[Technology] doesn't help us, but the attendance program is a help for teachers."

Teachers were also asked how technology changes what teachers and students do. They responded, "It (technology) will not change what they (teachers) teach. Maybe the speed changes, but not understanding of the material." "I'm not sure how much it will be helpful. One probably can use it, but it will be easier to use old technology." "At the moment technology is a crutch. For example, the calculator. Technology at the moment is not used to raise the level of education, but to correct what students don't know." "The Internet is a novelty, so it is used as such. Technology is not improving the quality of learning."

Critical Factors

In one respect, Cedar High School would seem to be the envy of many other schools. In this district there seem to be few problems with access. One student said, "We have a low student to computer ratio, there's always a computer available somewhere." Another added, "Teachers will let you use the computers in their rooms if you ask." "We have access to computers in the library and computer labs." Just one teacher complained that he "cannot use the (computer) lab when needed."

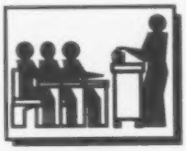
A critical factor in Cedar High School is the attitude of teachers towards technology integration. The teachers of Cedar High School expressed doubts about technology. A math teacher commented, "I am not willing to spend time to show something [using technology] because I need to show students how to do the math. I am not completely sold on the idea [implementing technology]." This math teacher allows the use of a scientific (not graphing) calculator only in advanced math classes. Another teacher offered, "On the one hand, using it is good, but I have reservations about integrating technology into the classroom. It was forced upon us, so we must use it, but does it make better students?" Yet another said, "The question is: are we driving the machine or is it driving us?" When asked about barriers to technology integration, a teacher responded, "Thinking that all disciplines need to implement technology uniformly. If technology does not increase achievement, I don't see why to use it."

Leadership is another critical factor at Cedar High School. It is unclear where the impetus for obtaining technology is coming from. Both the principal and the teachers credit the district technology plan as the source of technology. This plan was written by a committee that includes the superintendent, the technology coordinator of the district, the staff development leader, a parent, a board member, a community member, and a number of teachers.

The vision for technology integration seems to be very limited in this school district. The technology committee which wrote the plan for the district included purchasing of computers, setting up networks, establishing an Internet connection, building the ICN room, and providing staff development opportunities. That has now been done, and no one seems to know what else to do. The committee included for Year 4 of the plan a statement saying "Other specifics will be identified at the end of Year 3". The plan for Year 5 says only "Cost $30,000 to $35,000. Specifics for year five will be identified as the plan is evaluated and revised over the first three years."

This limited vision is shared by students and teachers alike. When asked what they would like to be doing with technology students replied, " We can pretty well do it now.", "It would be nice to have faster computers and better software.", and "It would be nice to have a full-time network administrator..." When teachers were asked what role technology would be playing in teaching and learning in 5-10 years they responded, "It will be the same. Perhaps a faster way of doing things.", "It will go in cycles. Technology gets so advanced that people will demand to put children back into classrooms.", "It will separate haves from have-nots." " Five to ten years is not enough time."

Cherry High School


Large

Urban

Low Tech

Setting

Cherry High School is located in a moderately-sized town which has access to several institutions of higher learning and which contains a number of corporate entities that are interested in working with the school.

The school itself is modern in appearance and was well maintained. Recent additions to the building have added facilities that are used by the community as well as the school. The school is large and very busy. The atmosphere friendly but purposeful.

Technology

Each teacher at Cherry High School has received a computer for use in the classroom. These computers are not yet linked with a Local Area Network, but this is planned for the following year. The school has chosen to emphasize the use of IBM compatible computers on the advice of the business representatives who serve on Cherry High School's Technology Committee.

The school has two computer labs. One lab has 24 computers of which eight were in use during the tour (2pm). The other lab has 28 computers with just one in use by a student when we dropped by. Both labs have Internet access for all computers and neither lab is open to students during lunch or before and after school.

The media center has seven computers, four of which have Internet access and may be used by students. At the time of the tour, all four computers were in use and four students were waiting for a turn. The media center is automated and has an on-line catalog.

Cherry High School has an ICN classroom that is in use six periods each day to teach foreign languages. The ICN room also was used to store seven older computers that were not in use.

The science teachers incorporate a lot of technology into their classrooms. One teacher uses a TV and VCR, laser disk, overhead projector, digital cameras and a video camera attached to a microscope. Another science teacher uses computers, telescopes, and both digital and traditional photography.

The math teachers report using graphing calculators in their classes. The art teacher has a set of eleven Macintosh computers which are used for graphics.

Uses of Technology

The typical technology use at Cherry High School is for word processing and Internet access. The science and math classrooms seem to be areas where technology is most frequently employed. Some teachers use presentation software to present information to classes, but this is not yet common.

The ICN room is a point of pride for this school. They offer foreign language instruction to eight different schools during six periods of the day. However, if a student is not enrolled in this particular foreign language class, he/she does not get an opportunity to use the ICN room. The principal would like to add a second ICN room in order to expand access and participation.

Impact

The impact of technology use is just beginning to be felt in Cherry High School. Teachers and students report having access to more current information via the Internet. One student described the impact of the Internet saying, "Teachers shove it down your throats. I used to have to know just what's in the book. Now I spend three or four hours outside of school (looking up information on the Internet) just 'cause I can."

The science teacher who uses the video camera attached to a microscope reports that it has reduced lab time by 60%. The camera is used to show the class what they are looking for in their own microscopes instead of having to do this individually.

The art teacher described the difference between a traditional pen and ink assignment and a computer assignment, "If I give the same assignment to students with ink pen I get one idea. On the computer, I'll get 45 ideas. There's more flexibility. Students can explore more and make more choices."

Critical Factors

Cherry High School has strong leadership and a clear vision of what they want to do with technology. This is a result, in part, of a Technology Committee that consulted with local business people to determine what would be needed in the future. The resulting technology plan has been the "basis for using technology in the school." Teachers report that "without the technology plan, we wouldn't have technology to use." "They made a commitment to spend the money for technology. I need to learn to use it." "In the last 5 years we've gone leaps and bounds. Their commitment made me decide I'd better learn it."

A critical factor for Cherry High School is access to technology for students and for teachers. The administration policy is that students must be supervised at all times when using computers connected to the Internet. As a result, the computer labs are not available to students during lunch hour or before and after school. All students must use the four computers that are available in the media center. Students and staff report lines of students waiting for access. Teachers also complain that the computer labs are used for business and computer classes and are not available for use by classes in other subject areas. One teacher said, "More computers are needed. As our use expands, what we have is all used."

The attitudes of students are a critical factor at Cherry High School as well. A number of students in the focus group questioned the wisdom of the school's investment in technology. They said, "What we spent on computers could have paid for two more teachers and books." "Instead of movable rooms, we could have built classrooms to help with the student to teacher ratio. That's what helps people learn, not 35 students in a room." They also expressed concern about being able to keep up with evolving technology saying, "They (computer industry) keep pushing the envelope forward, we can't get caught up. Bill Gates is the only one with enough money to keep up." And "The computers that were bought five years ago are junk. Buy books instead of computers."

The students also have misgivings about their preparation to use technology in the workplace. "Kids younger than us know how to do stuff we don't – like the database. We're stuck in the middle, we didn't get a chance to learn", "We'll have to learn it all over again two years down the road." "Once you start, it's not hard to relearn. They're not doing a whole lot to help us. "

Staff development is a critical factor for Cherry High School. So far teachers have been offered one and a half days of training in the use of Windows '95 and Microsoft Office '97. Approximately half of the teachers participated in these workshops. One teacher commented on the training saying, "Training occurred three months before we got the program. If training doesn't match our needs, we can't use it." The school plans to offer more classes on the integration of technology into the curriculum during the summer.

Technical support is currently being handled by a team of trained students. This group has been instrumental in helping the district wire buildings, and repair computers and solve software problems. Some of the students have even been hired away from the school to work in the private sector. However, teachers report they "need a support structure to make things work. That's the biggest frustration, it's hard to find that help." "Technical support is needed for an immediate fix," and "if you're ready to proceed and can't do it, someone could give you help."

Table 21. Percentage of responses via the WWW

	Participants		Random Sample		
	number	percent	number	percent	notes
Total surveys	385		399		1
Web responses	117	39.9%	16	9.9%	2
Mail responses	176	60.1%	145	89.5%	3
Total responses	293	76.1%	162	40.6%	4
Prefer web response	150	51.2%	48	29.6%	5

Notes

1 Due to attrition, 385 participants remain from the original 400.
399 Randomly selected Iowa teachers were mailed surveys.

2 Web responses as a percentage of total responses.

3 Mail responses as a percentage of total responses

4 Total responses as of 2/15/99

5 Those who used the web and those who said theu would prefer to use the web, but didn't have a chance to do so.

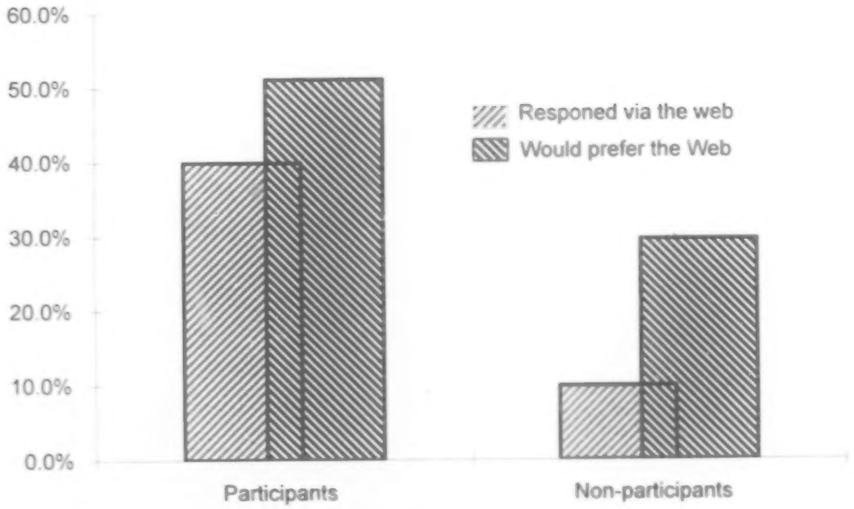
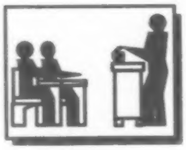


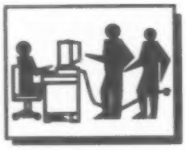
Figure 17. Percentage of survey responses received via the WWW.

Cottonwood High School



Medium

Rural 2



Low Tech

Setting

It was raining as we hurried toward the school. First impressions are important, and we did not want to be late. The school building is old and large -- three stories, with at least two obvious additions built on through the years. Inside, the atmosphere is friendly and family-like. The principal greeted us warmly at the front door and escorted us to his office to talk. The building has high ceilings, narrow hallways and stairways, and an orange color scheme left over from a few decades ago.

Technology

There are 21 classrooms in this high school, and each one has a TV monitor in it as part of the Channel One program. Eight of the 21 classrooms have at least one computer. Most of the computers are older models, suitable for little more than drill and practice software. There are two exceptions: the first is the special education classroom which has a new Gateway computer with CD-ROM. The second exception is a closet just off the science classroom that contains two computers that are used by four students taking Biology 109 from Iowa State University via the Internet.

The only Internet connections in the school are in the science classroom closet and in the room directly below it -- the library.

The library houses 14 computers, seven of which are connected to the Internet. When we visited, the library was crowded with students. The room holds a lot of shelves of books on one end, and the other has computer work stations. Half of the students were working on computers, while the other half busied themselves with the books and other resources in the library. The majority of the computer-using students were checking their e-mail when we walked through. Two of the students were working on videotape editing. The school owns two analog video editing stations, used to create news stories that are aired on the school's Channel One system.

There is one computer lab with 29 computers.

There is a small metal building in the parking lot that looks like a storage shed. It is actually the school's ICN classroom. The ICN room has been on-line for two years, but is not used often. It has been used for special projects, but no regular classes.

Uses of Technology

The uses of technology in this school are pretty basic. The students primarily use word processing software and Internet search engines.

The students in the industrial arts area are exposed to considerably more technology than others. The industrial arts classroom has 16 DOS machines networked together. The classroom has computer aided drafting (CAD) software, computer aided manufacturing (CAM) software, and a computer numerical control (CNC) mill.

The science teacher seems to have embraced technology in the form of the World Wide Web in an effort to expand this small school's curriculum. Four students are taking a biology course from Iowa State University via the Internet. The students come to the closet just off the science classroom one period a day and work their way through the class materials under the supervision of the science teacher.

The science teacher also has two Apple II Es in his classroom, used along with input probes for science lab measurements.

Impact

> *Emerging technologies such as computers, telecommunications, CD-ROM's, bar code readers, scanners, interactive video, hypermedia and videodisks are not in the hands of many students who attend (Cottonwood High School)"*
>
> *Technology Plan, p.2*

Because this school is just getting started with technology integration, they are struggling with some very basic problems. When asked to define technology integration, one teacher said he sees technology as a separate subject, and that "students must learn about the technologies and how to use the technologies" before technology integration can occur. This school is still working hard to get a grasp on the basics of technology use.

"Integrating requires more time because of the steep learning curve of technology", and that is a big hurdle for this faculty according to one teacher. Teachers seem to agree that technology is important for the students, and that they "must make a conscious effort to integrate the technology into the curriculum" despite the barriers.

The students are not satisfied with the level of technology integration at their school. "We need more assignments that require our use of the Internet and computers", according to one student. The students also want their teachers to be more computer literate. One student said the media center director is a good resource for technology information, and "a couple other teachers use computers, but they are always too busy to help." Another student is more to the point. "Teachers are generally techno-clueless."

Critical Factors

The Cottonwood School Technology Committee was formed in January of 1996. Before that time, technology was purchased when it was requested by a faculty member, with no coordination or communication in place. One faculty member says the state of the technology integration into the curriculum can be blamed on the fact that the "former administrator was not supportive of technological development".

Most of the teachers seemed to have little use for technology in their programs. The exceptions were the industrial arts teacher and the media center director, who each used technology heavily within their personal and professional lives. Other faculty members are using technology in a limited fashion in their personal lives and as a classroom management tool, but few are going beyond asking students to use a word processing program to write papers, and occasionally utilizing the Internet as a research tool.

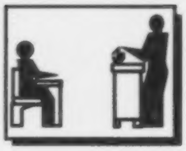
Some teachers believe the fact that there is very limited access to computer technology for faculty means they are wasting their time with technology-related in-service training. "The lack of computer resources negates the impact of in-service training. Teachers don't have the opportunity to use what is taught in in-service." Another teacher acknowledged the limited resources of time and training, and found it frustrating that teachers were forced to spend their in-service time on technology. This teacher saw this as a problem because "each teacher needs their own computer before they will consistently use it."

Others are asking for more in-service training. One faculty member summed it up this way: "Not enough time, equipment, knowledge, money or software." Other faculty members agreed with her assessment.

As this school struggles to catch up, they also worry about how they will keep up. “How will schools stay current with technology?” What about the costs of infrastructures and upgrades?”

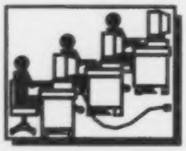
Although the principal is interested in upgrading technology use, the teachers see the level of visioning and sense of empowerment within the school as low. This is the principal’s first year here, and it is possible he has not yet had enough time to communicate his vision for technology.

Elm High School



Small

Rural 2



High Tech

Setting

This is an old building, with a number of additions built on throughout the years. The three-story building was once K-12, before the district merged with another.

The atmosphere at Elm High School is very positive. The students and staff are friendly and welcoming. The walls and lockers are covered with posters and signs created for students, by students. One sign congratulates a wrestler for a recent win, and has a scanned photo of the student, his win-loss record, and details of the latest victory. Another sign congratulates a state speech contest winner, a third is for a music contest winner. Each of the signs is personalized with a photo and school logo. The posters are everywhere. They give the impression that this school is filled with exceptional students, and the study body is very proud of their accomplishments.

Elm High School is located just outside a metropolitan area. The students are primarily from one of the two small towns that make up this consolidated district. Although the town where this school is located appears to be very typical small-town Iowa, the students have easy access to the culture and amenities of the nearby urban area.

Technology

This school has easy access to technology for the students. According to state statistics, there is a computer for every student in this school district. This small school has three computer labs, with a total of approximately 55 computers. One lab has 16 IBM computers for drafting and industrial technology, and Internet access for five of the 16 computers. The second lab has 21 computers, all of which are on the Internet. The third lab is the school's top level Mac lab, used for multimedia and computer programming. It contains 18 high-end Macs, all of which are connected to the Internet. The multimedia lab also has a digital camera and scanner.

Every classroom has at least one computer, most have two or more. The math classroom has 12 older Macs for drill and practice activities. The English classroom has five computers for word processing and Internet research. In addition to computers, many of the classrooms have other types of technology as well, such as laser disk players, presentation software, scanners, video cameras, digital cameras, color printers. There is a TV and VCR in each classroom.

There are also six computers set up on carts that are moved from room to room as needed. There are two stored on each floor of the high school.

There is a video lab with two analog video editing systems, two videotape dubbing systems, computer graphics capabilities, digital cameras, and scanners.

The school does have a receive-only ICN site, but it has not yet been used by the high school. The receive-only site has been used mostly for community meetings thus far.

Uses of Technology

Elm High School utilizes extensive word processing and Internet use in the classroom, but it also has integrated other technology use in the classroom as well. In addition to basic technology uses, students and faculty at this school have embraced the multimedia capabilities of their technology. They use multimedia extensively as a tool to create a positive school atmosphere, for teacher and student presentations, as well as in the school newspaper and yearbook.

Impact

The impact of technology use in Elm High School has been overwhelmingly positive. Teachers communicate extensively with each other, and technology is often what starts the conversation. The teachers are energized and enthused about the possibilities offered in terms of technology and teaching and learning. "I think it's neat that I get to learn something new and different everyday, too. When you have to troubleshoot a computer, or when you have a problem, it's a challenge. It keeps you active. I don't think you can ever know too much."

Teachers here tend to be focused on the students rather than the technology. They view technology as a means to provide students with a powerful tool that will help them after high school. "I've gotten to the point where I don't believe that I can teach facts anymore. The best thing I can do is to teach the students to be a life-long learner and a user of the resources available to them. And that's my goal for my classroom."

They also understand the motivation power technology tends to have for teens. "I think it motivates the kids. The kids are a heck of a lot more excited to sit down and do a lab with a computer. It's their tool. It's their mode of interacting, and it allows them to express themselves in ways that they couldn't otherwise."

Technology gives teachers alternative ways to assess students' learning. "It gives students ways to show us, to present it. I've had kids present a news article, give a broadcast, or put together a presentation. It allows them to produce something in different ways depending on how they learn. I've got kids who love to talk, and they are the ones who want to put on the news broadcasts, versus sitting down and writing it all out. And that allows you some flexibility to authentically assess some ways that maybe haven't been possible for them years ago."

Critical Factors

One of the most important critical factors for this high school is its technology history. Computer technology began to arrive at this school in 1990. The principal at that time was a strong proponent of technology with a vision for the potential impact of educational technology.

The principal began by encouraging teachers to purchase computers for their homes. He made it possible for the teachers to take advantage of the school's educational discount and allowed teachers to pay for the computers through payroll deductions. By making it easy for teachers to become comfortable with computer technology at home, he was paving the way for support for computer technology at school.

In 1993, the school participated in the "Computer on Each Teacher's Desk" program. This program funded a computer (up to $1000) for each teacher who wanted one. The teacher was required to keep the computer in the classroom for two years. After that, the teacher could take the computer home, if desired. A number of Phase 3 classes were offered on computer literacy and teachers were paid to attend the training. If teachers attended those classes, they earned enough money to pay for the computer. Most of the teachers took part in the project, and most of the teachers left the computers in the classrooms after two years.

This approach allowed the teachers to become familiar and comfortable with computer technology before attempting to integrate technology into the curriculum. "The students saw the teachers using technology and they wanted to use it too," according to a teacher. The students motivated the teachers to find new ways to integrate and utilize technology in education.

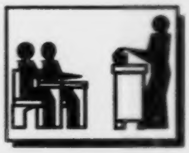
This administration also was very effective in communicating technology goals (and other goals) to the staff and students.

When the visionary principal left, things began to slide. The teachers and students continued to be enthusiastic about technology, but without someone leading the way and coordinating efforts, the progress towards technology integration slowed significantly. Individual teachers continued to approach the school board with financial requests for technology. Typically, requests were granted, but technology was advancing in a piecemeal fashion, and there was no longer an agreed-upon vision for the future.

About three years ago a number of teachers retired, and new teachers were added to the staff. These teachers were trained with technology and understood the educational benefits and classroom uses. This group re-energized the technology effort. The building was networked, e-mail capabilities were added, the students were allowed access to the Internet. The funding was found for a district technology person as well as a building technology person.

Nearly all of the teachers use technology in some way in their classroom. The teachers now seem to be the ones with the vision in this school. They appear to work together well, communicate well, and respect divergent opinions. Their primary interest is in the education of their students and they believe that technology is an important component in the formula for academic and career success.

Hawthorn High School


Medium

Rural 2

Low Tech

Setting

We arrived in the Hawthorn community nearly an hour before our scheduled arrival, so we dropped in at the local café. The dining room was divided into two distinct halves: the smoking section where the men were gathered and the non-smoking section occupied by the women. There were about 20 middle aged and older women gathered together at a grouping of tables. When queried, our waitress told us it was not the meeting of an organization, the ladies of the town just chose to gather twice a week for breakfast.

Hawthorn High School is located on a hill above the business section of the town and surrounded by houses. The school building is comprised of an older wing, built in the 1920s, and a new wing built in the 1960s. The school was a busy place with students and teachers hurrying from place to place. The hallways and classrooms were well-lighted and colorful with student work, posters, and announcements posted everywhere.

The principal of Hawthorn High School was friendly and made every effort to make the evaluation team welcome. He had a computer on his desk, but it was not turned on. He uses a computer routinely at home, but "at school my secretary does most of the work for me." During the interview he commented, "In all honesty, computers are still considered by many as an add on."

Technology

Hawthorn High School is wired for Internet access in all classrooms and the media center. Each teacher has a new computer with Internet access. Two laboratories are available for student use. One laboratory is used for computer classes (how to operate the computer) and the other is part of the media center and students require passes to use them.

The English teacher has four computers in her classroom as well as a laser printer and a digital camera.

The industrial technology department teaches a computer aided drafting course and the family and consumer sciences classroom has a computerized sewing machine.

During the walking tour, the researchers also noted that every classroom was equipped with a television, an overhead projector, a filmstrip projector and a 16mm projector. There were also several portable TV/VCRs on carts.

Technology Use

Although technology seemed plentiful in this school, there was very little evidence of its use. Of particular interest were the large numbers of filmstrip and 16mm projectors in evidence. It was as if they had cleaned out the storage closet and distributed anything that could be called "instructional technology" to each teacher. Students could only think of one teacher that used videos regularly and none could recall seeing filmstrips or 16 mm movies, but "every once in a while they use the overhead projector."

Computers were in evidence everywhere in the school, but computer use was minimal while the interview team was visiting, and the result of the focus groups indicated that computer use was not a critical component of the teaching and learning environment. Computers and telecommunications appeared to be limited to specific class assignments and mostly for computer literacy activities. Student use was "by permission only."

Word processing and Internet usage are not yet common at Hawthorn High School.

Impact

The only impact that technology has made at Hawthorn High School to date, is on the teachers. They report feeling motivated to learn about computers because they each have one on their desks. Their growing knowledge enables them to see some benefits to using computers with students, but it is not part of their daily activities.

Critical Factors

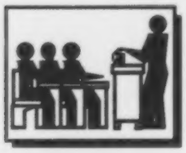
Hawthorn High School has a serious shortage of leadership and vision for technology use. The principal describes the faculty as a senior staff, many of whom are reluctant to use computer technology. He also stated that the school would receive an ICN room in 1999, but did not see much use for distance education and the ICN for his school. Several of the teachers in the focus group seem to be emerging as leaders in the adoption of technology. Their efforts are impeded by lack of training and time for experimentation.

Staff development is a critical need at this school. The principal reports that their AEA was "struggling to provide support" for them and that their location, 50 miles from the AEA Center limited the ability of teachers to attend training sessions. The current plan for technology training was dependent upon teachers finding training and bringing it back to share with their peers. One teacher was part of the US West Teacher Technology project and would be training his school's teachers in telecommunications.

Access is also a critical need at Hawthorn High School. Of the seven students in the focus group, four reported that they never used a computer at school. Teachers spoke of an earlier time when students were allowed to use computers during study hall, but "they played around" and permission was taken away. Teachers do acknowledge that as they begin to use computers more, students will need expanded access, perhaps during the evening hours. Currently, students with permission to use the computers can do so 20 minutes before or after school hours.

Attitudes toward technology play a large part in Hawthorn High Schools adoption of technology. The principal is skeptical of any benefits technology may confer and teachers are worried about their roles and the impact of computers. "Technology can be frustrating and dangerous without training." "[The] Internet is a liar's paradise." "I hope technology does not take away the social side [of teaching]."

Hemlock High School



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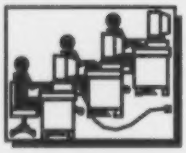


High Tech

Setting

Hemlock High School is located on a rise near a winding river. It is surrounded by upscale housing set amid towering trees. The day of the visit a gentle spring rain was falling. We approached the large, cinderblock building from the parking lot and entered near the gym. After winding our way past locker rooms and the maintenance shop, we emerged near the swimming pool and found a secretary in the athletic office. When asked how we could get to the principal's office she replied that although it was possible to get there from here, it was very complicated and, in the long run, it would be easier to go outside in the rain and walk around the building to the principal's office at the other end of the structure. We followed her advice.

Hemlock High School was built in the 50's and has been enlarged. The addition was added around the outside of the building resulting in a maze-like collection of parallel hallways distinguished by the presence (older structure) or absence (addition) of tile on the walls. The building appeared well-used and adequately maintained. On this rainy day, the halls seemed a bit dim.

As we toured the school, met with students and teachers, interviewed administrators, and even as we ate our lunches, we encountered people who knew who we were and why we were there. Everyone was friendly and welcoming and eager to share our cookies and juice!

As we met with teachers and students it became clear that we were not dealing with a cross-section of the entire school, but with the leaders in technology use. Four of the six students we met were part of the Technology Team that consists of 15 students who are enrolled in a special class and who load software on computers, troubleshoot equipment problems, preview new equipment and present training sessions for teachers. The teacher group also described themselves as "being more like each other than like the rest of the teachers in the school." The principal commented "...the first thing we need to face is reaching that point where the faculty is comfortable with the technology. When you look at our faculty, overall, we cover the gamut from folks that are very uncomfortable with things yet to those that are out on the cutting edge."

Technology

This school participates in the Channel One program which has provided a TV set for every classroom. In addition, each teacher has a PowerMac on her/his desk. Although we did not visit all of the classrooms, none of the classroom computers we observed were being used by teachers or students.

The school has an ICN room that has received 70 hours of class this year. The room currently is used for a Communication Media course and three courses from ISU. It was not in use during the visit.

The school contains four computer labs:

Lab One contains 28 Mac Classics plus a teacher computer and is used for teaching keyboarding only, it has no Internet connection. This lab was not in use during the tour.

Lab Two contains 25 Power PC's plus one teacher computer (PowerMac) software in use includes Adobe Photoshop, and MS Office All computers are connected to the Internet. Other equipment available in this lab includes a scanner, a digital camera, TV, VCR, and an overhead projector. Twelve of these computers were in use during the tour and four of the 12 were connected to the Internet.

Lab Three contains 25 Windows computers, which are all connected to the Internet. This lab is used to teach the Computer Applications course. Twenty-two of the computers were in use and all were connected to the Internet.

Lab Four is known as the CAD lab and contains 26 Windows computers. A local corporation has contributed Pro E software and training to the school and students who receive this training may serve internships there. The lab is used for a unified class that combines Math, English and ProE - students in this class spend four periods a day in the lab. At the time of the visit nine of the computers were in use by eleven students. Other equipment available in the lab included a plotter, TV, VCR, cassette recorder, speakers, and three printers.

Other islands of technology use were seen in the Physics lab where the teacher had 7 Mac Classics that had been updated and were being used to gather data during experiments. During the tour, three of these were in use. One of the computers had been set up as a weather station. The bulletin board included a list of web sites of interest to physics students.

The Special Education resource room contained four computers for student use and a teacher computer. None were in use during the visit. The teacher reported that students use the computers for the Cornerstone program to learn subject matter at their own pace and level. These computers are not yet connected to the Internet.

The Family and Consumer Sciences program requires each junior class member to take ‘Baby Think It Over’ home for a least one night. The school has 25 of the dolls including one dark skinned baby and one ‘crack’ baby. The biggest problem reported with this program is when the key to stop the "baby" from crying does not work, the principal has received calls from angry "grandparents" during the night.

Hemlock High School also has three radio broadcast booths and a TV station which are run in cooperation with a nearby community college. Within the studio students have access to three analog video editing stations and they can visit the community college to do digital editing.

The media center contains nine computers of which six are used for the on-line catalog, two for the automated circulation system, and one for students to do word processing. This last computer is also equipped with a printer. This summer the school plans to add 16 Internet connected computers to the media center for student use.

Uses of Technology

The typical level of technology use at Hemlock High School is for word processing in English class and some limited Internet access. Other technologies are available for student use, but are dependent upon enrollment in a specific class. Students report that they use graphing calculators in advanced math courses and computers to chart velocities in physics.

Teachers report using computers to keep their grade books and to perform information searches on the Internet.

This school has some innovative uses of technology associated with some school/business partnerships. The first example is the ProE software used in the unified class. Another example is the Electric Car project which is a school/community project. The participants include students, an architect, a machinist, and a teacher who meet after school to design, build, test and race a car powered by electricity.

The school seems to be a bit short of vision for future technology use. Plans include providing a minimum of five computers per classroom for student use and also making these facilities available for community use. The principal views technology integration as being "to use the tools that are available to assist them to accomplish whatever they want to accomplish". The district technology coordinator commented "We all realize that the integration of technology is continually changing... Our students have to leave this district with a good understanding of that and know how to use it to their best advantage." One student said he would like to "use the computer to use more applications that were more challenging." Another commented that a "practical application would be to learn stuff in business. I'm not even aware of what is used in business."

Impact

So far, the use of technology seems to have limited impact. Teachers describe "...an attitude change in students, they love it (technology)." Another commented that "It is pleasant not to hear students ask 'When will I ever have to use this?' anymore." In answer to how technology enabled students to change how and what they think, teachers responded " Students are feeling more like a contributor to the body of knowledge. They collect data and make a statement about it." Another teacher offered, "The hands-on activities help with special needs students, there is excitement about learning." The teachers also saw their roles changing "We'll be more facilitators, especially until we know more." "Technology has opened doors with the community. It is refreshing to know we're in touch with what's going on out there."

One student discussed a significant impact saying, "I changed what I was going to do with my career. I was planning to go into law enforcement, then I took Auto CAD and started working with ProE. Now I want to do that."

Critical Factors

There are a number of critical factors involved in determining how a district uses technology and what impact it has on teaching and learning. One of the first to be considered is the technology plan. At Hemlock High School the technology plan seemed to drive the purchase and installation of hardware and provided for teacher training. When asked how the technology plan influenced their use of technology, teachers commented: "I wasn't aware there was a written plan." "What is it?" "It is frustrating. They have not met deadlines for technology advancement. Since other schools seem to be going faster, there is much anxiety around. We need to learn more. We are not there yet as a faculty." Another teacher offered "I don't see a day-to-day impact, though that may be how we got the equipment." And finally, "We've had lots of in-services."

This district began to emphasize the use of technology during the 1995-96 school year. They have organized a technology team at each school and this year instituted a requirement that each teacher submit a written plan telling how s/he intended to use technology in the classroom. When asked how these plans were being reviewed/evaluated, the technology coordinator replied "This was done to give us a baseline of where teachers are at so we know what they are doing. It is not meant to be threatening to them in any way." Teachers commented that "The form we got was very confusing. Even smart people couldn't understand it. The form was copied, without changes, from another school district and didn't really fit ours." Another said "I am aware of the plan and district standard, but couldn't fill out the form." Finally, one teacher offered "I was in charge of collecting the forms. Many teachers would have used technology even if they didn't fill out the form. It was confusing, but it made people think, 'How can I use technology in class?'"

Access is critical to technology integration. Each teacher has a computer on his or her desk and all are connected to the Internet. This school has one computer for student use in the media center and requires that all computer labs remain locked during school hours. A student commented "You can go to a lab whenever you want, if you have a pass from a teacher. You can generally get in unless the lab is being used. You can't use the lab after school unless a teacher is there. I was using a computer after school without supervision and I was asked to leave." Another said "You have to use the computer during class time because there is no access otherwise." Yet another student chooses to use her own computer at home because of limited access. These students were part of the Technology Team and admitted that gave them increased access that other students did not get.

Students in this school do not have individual e-mail accounts. They say they can "get incoming messages, but not send any out." "We can't communicate directly with people, they do not trust high school students. Our Internet access is limited by 'Fortress.'" Commenting on this, students said "We should have more freedom." "They (administration) should be more trusting."

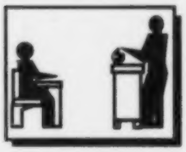
When asked about the issue of trust students admitted "We've had some problems, now we're paying for it. Even the tech team." "Tech team blocked from using DOS by 'Fortress'." Finally, referring to 'Fortress', "We figured out how to disable that in CAD lab."

The vision for technology integration did not seem strong among the school staff and administration. It may come from the district administration and/or the community.

Staff development was mentioned by all of the participants. When asked about its effectiveness teachers commented: "We get 'one size fits all' in-services. Our teachers represent the entire range of knowledge and experience. It's frustrating. I spent the entire in-services begging for more help." Another said "I've heard about a trainer/mentor program for subgroups. That would be great." "Most departments have good cooperation. I'd like to see a department trainer for technology. We'd have more freedom if that person were site-based to help teachers when they need it."

When asked where they get information about technology teachers responded" The Internet has good offerings... It is as sophisticated as you need it to be." Others named professional associations, conferences, the AEA professional library, AEA demonstrations, and summer workshops.

Hickory High School


Small

Urban

Low Tech

Setting

This community is a small one located next door to a large urban area. A river divides the community and on the day of the visit, the river was near flood stage with water escaping the banks in low-lying areas. The school is located on high ground and was not threatened by flooding.

The school building is on the edge of town and occupies nearly a full block. The building includes grades K-12 and all the administrative offices of the schools. The high school occupies the old multi-level school building with a long single-story addition which houses grades K-8. One of the hallways of the school is lined with the class photographs of each class to graduate from Hickory High School. The earliest photograph is dated 1898 and features the names and images of the two girls who comprised the Class of 1898 and the image of the first Superintendent of Hickory School District. Looking down the hallway, seeing through time, the same surnames appear and reappear as generation after generation of families attend Hickory High School; some returning as principals or superintendents.

The atmosphere of the high school is friendly and very busy. The ringing of the class bell to signal passing time brings with it a burst of conversation, doors flying open, and teachers and students scurrying to get tasks done in the four or five minutes before class begins again. The office also experiences this eruption of activity as students need to use phones, straighten out conflicts, or talk to staff. The principal pops in and out of his office in response to the needs of students or staff.

Technology

Each classroom in Hickory High School is equipped with one computer connected to the Internet. Each computer is connected to an inkjet printer on a stand-alone basis, with most of the printers having color capabilities. However, each teacher is issued one black ink cartridge for the printer and is required to purchase additional black ink and all color ink cartridges from classroom supply money.

The school currently is connected to the Internet by a 56K line through the AEA. This will change during the summer of 1998 when their ICN room is installed.

The business room is equipped with 15 computers, seven of which have Internet access. The business room also contains nine typewriters, a TV-VCR and an overhead projector. At the time of the visit, seven computers were in use.

The Media Center (shared by grades K-12) has one computer for administrative uses (library is not yet automated) and three computers with Internet access for student use. Attached to the Media Center is a lab containing 22 Apple IIGS machines connected via AppleTalk, and three networked printers. This lab is used only for teaching keyboarding skills and will be eliminated during the summer of 1998 when the ICN room is installed in this space.

Hickory High School also has a small PC lab featuring seven IBM compatible computers. These machines are not connected to the Internet and are used for word processing only. At the time of the visit, all computers were in use.

Individual classrooms had different technologies available. The Physics classroom had a computer that was being used for a parabolic flight demonstration. The computer was connected to the TV in the classroom. Other technologies included an oscilloscope and some older computers that the students dismantle and explore. The Music classroom contained 25 electronic keyboards which were on loan from the AEA for five weeks. Other equipment that was available to all classrooms included two scanners and two TV/VCRs on each floor.

Uses of Technology

The typical use of technology at Hickory High School is for word processing. The teachers and students also report using email quite frequently, but only the teachers have email accounts through the school. Students' accounts are through such providers as HotMail and Juno. Teachers and students both are beginning to use the Internet for research, but usually do it from home due to limited access at school.

Students at this school have found innovative ways to use technology including using their cell phones to order lunch from the local store (it delivers), emailing teachers to ask for advice, and emailing assignments to friends who have printers at home. The friends with the printers then bring the printed assignments to school. When asked if they use email or the telephone more frequently to communicate with friends, one student responded "On email I can talk to lots of people at the same time, on the phone I can only talk to one."

Impact

Technology has had limited impact on Hickory High School. Teachers report that the Internet connection allows them to "get information faster." But they also complain that the Internet is poorly organized and contains biased sites. Students echo their teachers saying the Internet is "faster, more advanced" and enables them to "do reports easier." But others point out that the "Internet is slow. You have to know how to use the search engines." Another offers, "I don't use it much."

Critical Factors

The Technology Committee at Hickory High School has supplied the vision and leadership for the adoption of technology. Made up of community members, school board members, teachers and the principal, the committee has constructed a technology plan to move teachers and students into technology integration. The school is in the second year of this plan with the goal to familiarize all teachers with word processing, email, and the fundamentals of Internet usage. The plan continues to specify the standard for computers at each school level and the software that the district will purchase and maintain licenses for. These software choices include PowerPoint, Hyperstudio, Adobe PageMaker, Print Shop Deluxe, Microsoft Office and Clarisworks. During the present year the goal has been to obtain sufficient software for all computers.

A Technology Coordinator has been added to the staff of Hickory High School this year. The technology coordinator is also a teacher who is released several periods of the day to trouble-shoot problems and prepare training for teachers. This addition to the staff has been welcomed by the teachers who appreciate the increased support.

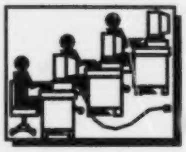
Training is a need at Hickory High School. The school provided five two-and-a-half hour sessions at the beginning of the school year for technology training. Staff were introduced to word processing software and email. Teachers are expected to seek out AEA workshops to further their training this year.

Finances are important at a small rural school like Hickory High School. The technology plan reflects only modest sums available for technology purchases. The state funding has been instrumental in the acquisition of technology for this high school. When the ICN room is installed this summer, teachers and students will be eager to participate in new courses. The principal is worried about how to pay for the students in those classes. He is seeking to form a consortium with other schools to offer classes to member schools without a tuition charge.

Joshua High School

Large

Urban


High Tech

Setting

Joshua High School is located on a rise within a large campus that also contains three K-5 elementary schools, and a 6-8 middle school. The entire campus looks up-to-date and very inviting. On the edge of a large urban area, the Joshua school district campus also includes a bird sanctuary and a prairie habitat.

We arrived at Joshua High School after classes had begun. The hallways were large and empty. The floors were carpeted and the walls line with lockers. All were decorated in neutral colors with posters and flyers limited to small bulletin boards. The first couple of doors we tried led to the gym and to the shop areas of the school. Finally, we found a student who directed us to the second floor office.

This was a very interesting visit. Over the phone, the principal was very welcoming and seemed eager to participate in the study. When we arrived we were welcomed and shown to a guidance conference room that had been reserved for our use all day. The interview with the principal also included the superintendent of the school district and the district technology coordinator. The three seemed to get along well, all were called by first names and the technology coordinator was clearly not intimidated by 'superiors' being present. The superintendent and technology coordinator seemed much more conversant with technology than the principal.

Following the interview, the technology coordinator took us on a walking tour of the building during which he imparted the superintendent's philosophy "The three R's –

re-teach, rethink, or relocate." This seemed to reflect a hard line attitude toward those who did not agree with his program.

Although we explained that his presence at the focus groups could inhibit discussion, the principal remained with us for both focus groups. Of the students he said "I work with these kids all the time, we have a good relationship. They help me work out problems. They will tell the truth and be honest." During the student focus group, all eyes were on the principal and many students declined to participate. Body language observations showed students slouching, placing their desks so they were behind other students, and avoiding eye contact with the researchers. We were forced to use other tactics to get information such as "Raise your hand if you have a computer at home." In this way, we were able to gather some information, but the entire focus group took only 20 minutes. At the end of the focus group the principal said, "That went well, they were honest and told the truth."

The principal also elected to stay during the teacher focus group. He took notes during both focus groups. The teachers were more talkative than the students and were willing to bring up some negative aspects such as what could happen to a teacher if s/he didn't achieve the Level Two technology goals by the end of the year. At this point, the principal jumped in with "We'll just give them more training, this is an atmosphere in which people can feel safe." That effectively stopped the conversation. The atmosphere was not relaxed and easy-going, as much as the principal wanted to present that image.

Joshua High School constructed their first vision of technology use in 1990. That plan has been followed and continually updated. Purchases are coordinated district-wide to ensure compatibility and equity.

Technology

The Joshua School District buildings are all connected by a wide area network, Internet access is via a T1 line. Students and staff have file server storage space they can access from any networked computer. In cooperation with the local phone company, the district offers dial-in access to the Internet to over 500 families. All K-12 faculty have a networked desktop computer – many connected to large screen classroom televisions. All students and faculty also have email accounts through the school. CD-ROM towers allow classroom access to a variety of reference sources via networked computers.

Joshua High School has 240 computers (including five Apple IIGSs) for student use. There are three computer labs primarily for instruction and a Success Center that is always open for student self-referral. In addition to computers, the labs contain TVs, VCRs, scanners and printers.

Teachers and administrators use MacSchool software for attendance, scheduling, grades, and access to student records. There is also a program that contains the school curriculum.

Physics and Chemistry departments have eight computers in a lab, probes for timing, sonic range finders, sound samplers, thermometers, and pressure sensors. They also have interactive physics software, a CU-See Me camera, lasers, holograms, a gas chromatograph, an atomic spectrophotometer, laser disks and a laser disk player, as well as a set of 10 TI-83 calculators for use with calculator based laboratories.

English classrooms contain mini-labs (five computers in the back of the classroom) for word processing only.

The media center has 18 computers, six for the on-line catalog, six multi-purpose machines, and three for word processing.

The high school also has an ICN room which is used two-three periods a day for classes.

Every classroom currently has a television from the Channel One program. These will be replaced during the summer of 1998 with 31-inch televisions and the Channel One program will be discontinued.

Uses of Technology

The teachers we spoke with have integrated technology into the curricula that they teach. Every teacher cited multiple ways students use technology beyond word processing and Internet research. The physics and chemistry teacher commented, "In the science areas we use it to extend our senses in data gathering. " Students also use computers to analyze their data, PowerPoint to present their data, and the ICN to exchange data with other classes around the state."

Special education students use calculators for basic functions daily, they use computers for word processing, spreadsheets, media presentations, graphics and Internet research. They also use their email accounts to communicate with the businesses where they work and their own parents.

The social studies teacher uses spreadsheets, media presentations, a VCR, calculators and overhead transparencies. Her students are also asked to create and use these, but they have to go to the computer lab in order to accomplish these tasks.

The majority of math classes at Joshua High School use a TI-81 graphing calculator. One teacher reported, "One hundred percent of my students have one in their hands and they have it for the whole year." "It is a computer in the hand that gets to go home with the kids every night." The teacher also has an LCD panel to project the TI-82 on the screen for demonstrations.

Every teacher interviewed gave multiple examples of how technology was integrated into their classrooms. "When it's appropriate, we use whatever piece of technology is out there to do the task." Another discussed the plight of the transfer student, "If you get someone from another school that is not used to technology – that is the student that comes in and is almost in culture shock because they need to know 'What is this?' You forget that not every school has what we have."

Impact

The teachers at Joshua High School describe the impact of technology as changing the roles of teacher and student. "In a lot of classes it just lets the students know they have to find the information instead of [me] standing in front of the classroom giving it to them." "Instead of regurgitating, they have to find the information. They are the workers." Another teacher spoke of what follows the location of information, " I think because technology has allowed them to find the information more quickly and easily, we're able to spend more time with them as they learn to massage the information they've found and make their work uniquely their own." "It is a more individualized kind of learning."

A math teacher spoke of the impact in that field, " Parents really shudder about calculators if students use them for mindless things, but I try to make them use them to discover concepts that [they] couldn't have before because it was too time consuming."

Critical Factors

Joshua High School has benefited from being part of a school district that has taken an aggressive approach to the integration of technology. Beginning in 1990, the district formulated a vision for technology use and has implemented it across the entire school district. Technology use begins in kindergarten and the district has devised technology skills objectives to be achieved by grades three, five, eight and

11. By the conclusion of 11th grade students will demonstrate mastery of a digital camera, and a video camera, as well as being able to manipulate images, create multi-media products and write them to a CD. Software proficiencies include: Adobe Illustrator, PhotoShop, HyperStudio, Adobe Premiere, Sound Edit 16, FileMaker Pro, ClarisWorks, Excel, Adobe Pagemaker, and PageMill. It is presumed that these skills will enable students to prepare their required graduation portfolios and presentations.

Students in the focus group described beginning to use computers and other technologies in the 6th grade. They found it difficult to answer the question "How does technology change how and what you learn?" because they have been using it for so long. One student compared her technology preparation to that of her kindergarten-aged brother, "So he had to come home and he got on the Internet in AOL and all over the place. It was really cute, but I think it helped him 'cause he knows how to use more things than I know how to do. [He] made me feel kinda dumb."

The Joshua School District has also described three levels of competency for teachers to achieve in the use of technology. This is a more recent addition with the second year competencies being finished by the end of the 1998 school year. One teacher said, "Not only knowledge of many of the things we've talked about, but also demonstrated use of them." When asked what the consequences were for not achieving the competencies in the require time, the principal replied "Then we will provide more courses." A teacher followed with, "It's not an option."

Staff development has been a key component of this adoption of technology. The district technology plans specifies that "A half-time high school teacher currently serves as a technology mentor, assisting with multi-media presentations, Internet integration ideas, and hardware/software issues. Our 'technology learning culture' is also supported by seven faculty members who regularly serve as staff development trainers supporting seventeen technology courses." The school also employs "technology learning dyads or buddies" which have proven successful in gaining skills in the use of scanners, Internet, digital cameras, MacSchool, multimedia presentations and creative applications of email. Staff have four technology in-service days each year and can pick from a wide range of classes that reflect the technology competencies.

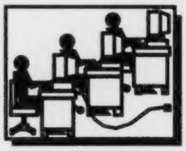
Access to technology at Joshua High School has been supported by the use of filtering software that enables administrators to provide email and Internet access without further supervision. The school also has a policy that gives students choices. They are required to have class during five of eight periods daily, the other three periods the students choose where they need to spend time: Success Center, media center, or computer labs. The principal affirms, "Students can make good decisions, responsibility is learned." Students and teachers also find ways to increase access including using the superintendent's desktop computer and giving students permission to stay home to use their own Internet connections for assignments. English teachers report that the word processing computers in their classrooms are available for students whenever the present class is not using them. Thus, a student from a first hour class may return to the English classroom during a lunch hour or study hall in order to complete a writing project.

Access to technology for teachers is a function of their readiness and willingness to use it. The principal commented, "We will give you the machine you can use, either a horse or a pony." Teachers who were initially reluctant to use computers received the older, less capable machines. Some are now limited by that decision. "...the biggest nay-sayer is now wanting to do things he doesn't have a big enough or powerful enough machine to do. He wants to be able to hook it up to his TV monitor and be able to show kids things on web sites and he can't do it." In order to upgrade to a newer, more powerful computer, teachers must submit a plan for the use of the new technology. The technology coordinator offered, "Teachers have to be willing to challenge the base assumptions of teaching. When asked what they need, some say 'a newer VCR, overhead projector and screen.' Having people examine outcomes leads to 'How do instructional styles meet needs of multiple intelligences?'"

Maple High School

Large

Urban



High Tech

Setting

Maple High School is located on a busy street on the boundary between residential and commercially zoned areas. It is an old school that has seen many additions, but has preserved the original oak woodwork in the entry and the halls. The many additions have spread the school over a large campus which occupies a small hill. Student parking is allowed at the bottom of the hill only and the morning migration of students evokes the image of a busy anthill.

The school seemed clean and well-maintained. Newer additions feature large windows and more spacious rooms. None of the classrooms are air conditioned. The day of the visit was very hot and humid and the students were wearing clothes designed for the heat. The conference room set aside for our interviews and focus groups was air conditioned and cool. Participants were most eager to be present and to stay as long as possible.

Technology

The Maple School District has a written document describing its technology vision. This vision includes daily exposure to technology in classrooms, multiple opportunities to use technology for instruction, to solve problems, retrieve information, and express creativity. Teachers will use technology daily to communicate, teach, evaluate and record student achievement. Technology will also be used regularly to deliver instruction in all curricular areas. This vision will guide the development of technology use in this district, but it is not yet a reality in Maple High School. The technology coordinator described the current state of technology, " We are really at the base level. We are on the ground level and there are a lot of changes on the horizon."

The high school currently can be characterized has having islands of technology. The principal estimates that of the 124 teachers in the school, "...about 15-20 of them are technology experts." Each of these experts seems to have built their own island of technology use. For example, there are four computer labs each containing 25 computers, but these labs are used exclusively for the business classes. The students enrolled in the "Technology Today" course have the opportunity to work with a flight simulator, digital electronics, 3-D studio, digital photography, television broadcasting, video production, computer aided drafting, laser and fiber optics, robotics, computer animation, and residential plumbing and wiring. However, this is an elective course, not typically chosen by college bound students, and students spend just 10 days on each of the labs they select. Teachers of math are using graphing calculators and teachers of science use temperature probes and video cameras attached to microscopes. One of the social studies teachers uses email and video conferencing daily to enable students in the international relations course to participate in simulations from the University of Maryland.

The media center contains twelve computers, of these one is available (though stored out of sight) for supervised use of the Internet , four are for the library catalog, one is for searching an index of periodicals, one is for accessing NewsBank, and five are for word processing and database use.

This year is the first year that each teacher has had a networked computer with a printer in her or his classroom. The district allowed teachers to order either a Macintosh or an IBM compatible computer "taking into account their present knowledge and the amount of time and dollars needed for training." Approximately 80% of the teachers chose Macintosh computers. The tech plan asserts "The dual platform will then reduce the amount of training funds needed as the workstations are installed."

Impact

Technology has had little impact on Maple High School so far. As the principal put it, "We have to have more access for kids, and we are not there yet....We have no net connections in the labs or the library. We will have standardized parental permission for Internet for the first time this fall." The teachers spoke of the impact of technology only in the future saying, "Students will have more personal technology." "We will spend less time on administrative duties, and we will get grades done quicker."

Students reported having unlimited access to information as a result of Internet access. However, the Internet access they referred to was in their own homes and not at school. One student said, "The amount of information available is incredible. You can find what you need." Another adds, "Research on the net is easier than the old fashioned way." "With the Internet you get views from people all over the world instead of just here in (city name)."

Students commented about other technologies that were used in school, "It (graphing calculator) makes calculus a lot easier. You hit the buttons and skip a lot of work." To which another student replied, "We'll advance faster because we don't have to think as hard. We think beyond." One student sounded a note of caution saying, " I think we use technology as a crutch. It is almost scary. Will we be expendable in a few years? Will machines do our work? Will more people be living on the streets because of technology?"

Critical Factors

Staff development is an important part of the Maple High School technology plan. The school is committed to doing their own staff development and only rarely uses the services of their local Area Education Agency. The preferred source of staff development is teachers who have developed expertise on their own or through attendance at conferences or workshops. This year the staff development offerings included two hour sessions on basic computer applications including: word processing, spreadsheets, data bases, Internet use and a simple authoring program. Other classes focused on how to operate a Macintosh computer and how to do research electronically.

Despite these efforts, students report that most of their teachers are not using technology in the classroom. "You are lucky if you have a teacher who knows how to use a TI85 (graphing calculator)." "It's like watching my parents learn to use the computer (laughter). It doesn't look like fun." "The (science) teacher doesn't know much about computers, but she tries." Another student offered this prescription, "In order to keep teachers using technology effectively, they need to use it constantly like we do so they know when things change."

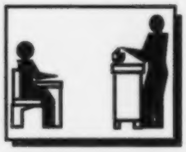
The teachers at Maple High School see time as a barrier to the integration of technology into the curriculum. As one teacher said, "There is not enough (time) to learn how to use it, or how to use it in the classroom." Another offered, "We are moving towards more teachers teaching six periods each day, which leaves 49 minutes of planning time daily."

The teachers also proposed solutions to this problem, "Perhaps we should consider block scheduling." "We hear a lot about restructuring. We should take the technology and do something new. We don't need to see every kid every day."

Access is a critical factor for Maple High School. At present, student access is severely limited. As previously mentioned, the principal acknowledges this limited access. He also commented, "It's amazing how many students have a computer at home – 70%!" One of the students in the focus group, when asked if he felt prepared to deal with technology after graduation, said "I'm prepared with technology, but I didn't get that preparation at school." This raises the problem of equal access to technology and the teachers expressed concern saying, "Some students can't afford the technology. Those who have access to a computer at home have a tremendous advantage over those who don't." Another proposed, "It would be nice to have a computer for every student who needs it in our class."

The technology plan for Maple High School is coordinated with the Maple School District plan and describes the acquisition of hardware and software over the next four years. The principle activity for the current year was the placement of a computer on each teacher's desk. However, the plan does not call for those computers to be connected to the Internet until the year 2000-2001.

Orange High School



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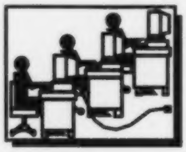


High Tech

Setting

Orange Community School District serves several rural communities. The six schools comprising the district are split between the towns. Orange High School is located near the center of a small, rural community. The school building is an older three-story structure which has been equipped with an elevator to provide access to those with disabilities. Despite being well-maintained, the building shows its age.

The atmosphere within the school is relaxed and informal. In fact, students referred to one individual by first name repeatedly and this individual was a teacher. The principal also had given responsibility for recruiting students for the focus group to several students. The entire staff was friendly and cooperative. The principal was interviewing prospective teachers on the day of our visit and extended his day past the usual quitting time to accommodate our interview.

Technology

Orange High School is at the end of the first year of a five year technology plan. The school participates in the Channel One program which has provided TVs for each classroom. The school has two computer labs – a new Macintosh lab and a PC lab. The PC lab is used exclusively for business classes with the same teacher occupying the lab for the entire school day. The Macintosh lab is used two periods a day for classes and is available during the balance of the school day for use by students and other classes. The only Internet connections in the school are the Macintosh lab (all 20 stations) and two computers in the media center. The school intends to supply each teacher with a computer after they take a three credit introductory computer course, but 20 percent of the teachers have not received them yet. The industrial technology classes use CAD software with a color plotter and a computer operated mill.

Orange High School has an outdated network in use in the computer labs. Teachers report difficulty in keeping computers on line and stated that wiring problems exist due to the thickness of the building walls. A wireless network was rejected due to anticipated cost. The principal acknowledges these restrictions and hopes the school board will raise money through a bond issue and build a new school.

Orange High School also has an ICN room and this has been the focus of much of the technology development in the school to date. When the ICN room was first installed, the principal taught the first course to model how to teach over the ICN and to encourage teachers to do likewise. The school is part of a consortium of 5 schools who share the same bell schedule. Each school offers a course to the others without charge. At present students at Orange High School are participating in classes on sociology, business law and advanced speech. Orange High School teaches calculus to three other sites.

Uses of Technology

The typical technology use in Orange High School includes using the Internet for research, word processing, and use of the ICN classroom. Individual teachers also report using presentation software, graphing calculators, and video cameras. Software in use at the school includes an integrated office system, grade book software, a CAD program and music software.

Impact

Technology seems to have made little impact on Orange High School. Teachers report that presentation software makes it easier to teach the same topic to several classes. A student reports that use of the Internet, "...makes it easier to find information and see a broader aspect of the subject." The principal stated that use of the ICN "...stimulates teachers to be more organized. It gets them excited and they teach better and kids learn better. There are also less discipline problems and more academic performance."

Critical Factors

Funding is a critical factor at Orange High School. As part of a small, rural district, funding is very limited. The district technology plan budget reveals that the annual funds available for technology over the next five years begin at $35,000 and decrease over the life of the plan to $23,000. This budget covers not only the high school, but three elementary schools, a junior high school and a kindergarten building. Phase III money and School to Work money were used for workshops for teachers. Also, local grants totaling $10,000 were available for teachers on a competitive basis. These grants were to fund innovative uses of technology.

Access is also critical at Orange High School. Students report, "I need my computer at home because I don't have enough time with a computer at school." and "The high expectations for word processing are not fair, because of the unequal access for a student who has no computer at home." All the students in the focus group agreed that while some computers are available, resources are tight. They also agreed that more technology was needed. One student added, "We need to know more so that we are ready for college and work."

Teachers also report difficulties related to access. One said, "I like to do research, but classes are in the Mac lab when I want to use it. Sometimes I want them to take a test or write a report, but they can't get there during class. Some will have to hand-write them."

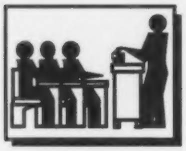
Students also indicated a need for more training in Internet usage saying, "I need to know more about basic Internet protocols and Internet software." "One needs to be told how to find things on the Internet," and "We need more instruction on the Internet."

Teachers and students both had words of warning about the use of technology in school. One student said "We should have more technology, but there is a limit to its usefulness. We need to know the basics before we become too dependent." Teachers commented, "Some things shouldn't depend on technology. Students need to know grammar." "I'm reluctant to do accounting on the computer, kids want to be able to just type the numbers in so they will go to all the correct places. I want them to understand why the numbers go in those places."

Other barriers to technology that were identified by teachers were inadequate staff development and scarce technical support. About staff development teachers said, "Inservices need to be different. We can't learn it in one or two hour inservices. We need more time more often," and "It would be nice to have inservices that are not lame, but something more meaningful and make it more available." Teachers also asked for training in software specific to their needs including authoring software, presentation software, and accounting programs.

Technical support is currently provided by a half-time person who is responsible for three schools. The building technology person is available one period a day or must use his own time. Several teachers spoke about a problem with the security package that affects the starting of computers, "If you don't shut off the computer right, you have to boot it up twice." "It takes 10 minutes to boot up." "The safety (security program) re-boots it automatically." Finally, a teacher commented, "We need a resource person close so we won't have to interrupt classes."

Palm High School



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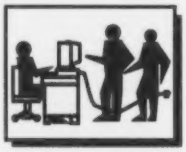


Low Tech

Setting

The Palm Community is a fair to mid-sized town, with lots of large old homes, stately lawns and over-arching trees. There is a large factory in town that employs most of the blue-collar work force in the area, especially those just out of high school. Most everyone else commutes to the nearest large city, a good 45-minute drive from Palm. There is a lot of money in the community, but it either comes from the factory or from outside town

Palm High School, built in the late 60's-early 70s, is a large, low-slung dark brown brick building with red trim. Inside, the brick continues, making up all interior hallway and public area walls. There is red everywhere--red trim, red doors, red lockers, etc.

The Principal was unfailingly polite during our visit, but equally as persistent in remaining with us at every turn. It became clear during our discussion that this principal has had to fight very hard to push technology into his school, and that he wanted to show us how much he'd been able to do with so little. Therefore, the set of teachers selected for our focus group was made up of the members of the technology leadership group--the ones who'd written the school technology plan. The students, too, were handpicked--all seniors, all accepted to some form of higher education, and all very polite. There was no sense that the principal was "hiding" anything, but was rather putting his "best" foot forward.

Technology

Palm High School has limited technology resources. They have chosen a PC format for the entire school except for the art and journalism classes. There are, in effect, three computer labs in the school. The first is the official computer lab, which contains 24 PC computers, 12 with access to the Internet, and three printers. The air was rather close, and the lights were dimmed to see the computer screens without glare. The lab door was locked. All computers were in use at the time of our visit, and we were informed that the lab is very tightly scheduled. The second lab is an open lab. Located in a low door-less alcove fronting the central square study hall area, it consists of eight out-of-date PCs and a printer. There is no Internet access. This lab is open at all times and is meant for word processing only. There is no required supervision (though there is a study hall teacher within sight). The students are encouraged to use these as much as possible for writing papers and finishing class assignments. There were four students in the lab at the time of our visit. The third is the Tech Lab, which is shared with the adjoining middle school. This lab is primarily reserved for the Industrial Technology and Electronic Communications classes. It is comprised of a huge open space (a converted auto shop), ringed by twenty PCs, which are networked together. They all have Internet access. There are also three printers and a scanner set up on an island in the center of the room. The computers are loaded with software for the CAD classes and are all hooked to modems for teleconferencing, e-mail, etc. This is the most sophisticated lab in the school. There were five students in the lab while we were there.

The Library/Media Center is an oasis of light in the center of this dark brick school. It has high ceilings, white walls, plants and skylights. It also has five centrally located computers for the facilitation of the automated card catalog. Three of them were being used during our visit. All of these computers have access to the Internet for freshman year Internet Introduction. The Media Center, five small rooms along the right side of the Library, contains offices for the library staff, the ICN room, the depot for equipment, and a video editing room. They contain TV/VCR sets, 2 full (though somewhat dated) analog editing stations, several low-end video cameras, a digital camera, and a small sound board. There were several students in the editing room, but no one in the ICN room, which is used mostly for classes for the students, staff and community. Three or four months before our visit, Palm received a hub for Public Access TV, but they are not yet broadcasting the school newscasts.

The Guidance Center has five PCs with "Choices" software and a printer. The Art room has a brand new Power Mac for graphics, but it was just out of the box and not yet in use. It is one of the only Macs in the school. The other two are in the journalism classroom to facilitate transfer of information between the school and the local paper. The students also report the use of TI-83's in their classes, but we did not see them.

The Technology Coordinator's office was a small suite of rooms located near the enclosed hall that connects the middle and high schools. The rooms were bright and cheerful, though cramped, with service counters covered in cables and random "parts" in the front room and floor to ceiling bookcases in the back. The shelves were full to overflowing with a bright jumble of manuals, magazines and books. There were colorful, cheery posters about technology tacked to the walls, printed banners of encouragement, and a collection of stuffed elephants on the technology coordinator's desk--right next to the top-of-the-line Power PC/scanner/ printer set up and the Mac E-mate.

Uses of Technology

The typical level of technology use at this school is for word processing and limited access to the Internet for research and structured class assignments. There is some use of database in business classes. Students report using graphing calculators in their math courses and receiving/giving PowerPoint presentations in some English classes.

The vision of the future held by this school is total integration of technology into the curriculum. They don't want to be teaching "how to use a computer", they want to use the computer to teach their subjects. Their next step is to get a computer on every teacher's desk. This will happen over the summer.

Impact

Technology is a highly anticipated event among the staff and faculty at this school. Though there is little technology presence on a large scale, there is a great enthusiasm for it. They hold technology in-services, informal training periods and peer discussions on technology they would like to see. The teachers will not be getting computers on their desks until next year, but they've spent the last year training and planning how to use the computer in their classroom. The principal says, "Right now we're training before we get the software and equipment, which is a bit like putting the cart before the horse, but we need to be prepared." The teachers spend a lot of their free time researching how to incorporate technology into their classroom. They say, "we have mini-seminars after school and evenings where a teacher who has learned something, like PowerPoint, will teach the rest of us how to use it."

The students we talked to were mainly content with their use of technology, and felt confident about their use of it in the future, but all of them had a computer at home and had not gotten the majority of their technology experience at school. The students in the group were all seniors on the brink of graduating as well, so this new technology wave sweeping through the school had little effect on them. They did express approval of some of the new things they'd seen, such as one student who approved of the new graphing calculators, saying, "It's easier to understand concepts when you see them right away. You see an immediate relationship with what you're doing." They also felt that the Internet was a help, "five or ten years ago all of the information would have been a lot harder to find, and now with computers and the net it's....just so much easier to find." Others were less enthusiastic, "I prefer the paper graphs. Calculators just mess things up, I...and what happens when the Internet doesn't work right? I don't trust technology very much."

We found the principal and the teachers were more excited by the technology than the students were. Whether this attitude was specific to this group of seniors, or present throughout the student body is unclear. The teachers were much more informed with what is out there technology-wise than the students were. When we asked students what sort of technology they would have liked to see used in their classrooms, they couldn't answer. It seemed like they didn't know what was available besides word processing and the Internet. One student said that his father received a couple of computer magazines and that he sometimes looked at them but, "there's not much to look at."

Critical Factors

Palm High School has only recently begun the journey on the technology highway. Prior to the current principal's arrival, there were no computers networked in the administration offices, and perhaps a handful of computers in the whole school. The former administration did not support technology, so there were not many on staff that had any knowledge or experience with it.

The three most important factors in the Palm Technology plan are acquisition, staff development and curriculum integration. Because the funding of equipment acquisition is so time-consuming and problematical, Palm High is taking an innovative approach by training its staff in the use and more importantly the possible methods of integration into curriculum, of technology it hasn't even acquired yet. By making the teachers comfortable with the technology that will soon be resting on their desks, and moreover sharing insight into how the technology may be utilized to expand their possibilities of instruction, Palm High School is fostering an eager group of teachers who can't wait to get their hands on those computers.

The end goal of technology at Palm High is, as the principal says and the teachers reiterate, "total curriculum integration." There is a great reluctance to simply "teach the machine" and an overwhelming enthusiasm expressed for "using technology to teach what we've always taught before, but to go beyond." The "vision" section of the Palm Technology Plan says, "Through the effective infusion of technology throughout the curriculum, Palm envisions a 'new classroom' where teachers and students are not isolated by walls but connected with worldwide sources of information; where students are self-directed learners interacting with peers, teachers, experts from various fields, as well as with electronic technologies; where learning involves presenting students with authentic tasks, projects or investigation; and where learning is the constant and time is the variable. The provision and effective utilization of technology will greatly assist transforming this vision into reality at [Palm High School.] "

There was little foot dragging in the attitudes of the teachers we talked to about technology use, though this could be accounted for in their being the authors of the school's technology plan. Most of them expressed personal excitement over the possibilities technology offered them in their classroom. Though the "responsibility" to prepare students for the 21st century was there, it was expressed a little differently by one, who said, "The kids have this stuff at home, if we don't learn it, we can't help them use it."

The attitude at Palm regarding technology seems to be enthusiasm, especially at the teacher, technology director and principal levels. The teachers said things like: "I don't teach specific information anymore, now I teach how to find information.' "There's more independent study available now. We used to have to blanket teach, now we go find specific interests after we've covered the 'basics.'" "It [technology] helps level the playing field. Now the student who can't draw uses the computer and his project looks just as good as the 'neat kid'. It gives them pride in their work." " In five to ten years will we still be here? We may become more facilitator than lecturer.

We can connect to more community leaders, people at NASA, business professionals. We have more opportunity to teach our kids by letting them talk to these people."

The technology director is enthusiastic as well, "By teaching teachers to use all the possibilities that technology makes available, we are fostering life-long learning in our teachers as well as in our kids. It makes learning exciting for everyone. By making people comfortable with the tools, we allow them to find their own ways of using them to create something new. It's not just the students who need to be prepared for life in the 21st century, it's us older people too."

The principal echoes some of these same thoughts, "It just expands what they can do. Good teaching is always good teaching, whether they use a computer or not. The same with bad teaching. [Technology] helps excite the kids. It helps teachers organize, and gives them more research and communications possibilities. The power they'll have is only restricted by their imagination. The things we'll be able to do are mind-boggling."

The kids we talked to, however, through their limited exposure seem to think there's not much out there beyond word processing and the Internet. Some of them were in favor of the changes in the classroom, such as one student who said, "There's more individual learning on the computer. I took this one class...and he just gave us a book and said go. And we did it all at our own speed. Then if you have questions, you'd just ask him. I liked it a lot better than just a normal classroom. There were some who had trouble, but if there were questions, you'd just ask him. He'd help us, no big deal. It'd be a lot better to have more classes at your own pace." Some said technology "makes you pay attention more", and that it seems to make teachers "more organized." Others greatly disagreed, like one student who had this to say about his technology class: "I don't know why, but it just seemed like I wasn't getting taught. I had to figure everything out on my own. He was giving us too much freedom to the point where it was kind of annoying. There has to be some structure, cause if there isn't any, well first of all, half the class was screwing around on the Internet and the other half is just like struggling to keep up…it wasn't really clear what he wanted us to do…you could go one way or the other way and the two ways were so similar that you don't know which way he wants you to do it. And half the time I didn't know what I was doing." When we asked if he was uncomfortable with that style of learning, he said, "Yeah, cause that was the first time I've ever done anything like that. I didn't know what to expect and then after that it was just kind of like I didn't know how to do anything."

The leader of this technology wave is most definitely the principal. Not content to wait for something to be recommended, he goes out actively seeking information on new technologies, as he says, "I have a personal interest. I question technology people. I'm a visual learner and I'm interested in puzzle solving. When I see something new I have to play with it and figure out how it works. I see a lot of technology at other schools [that I want for mine]. The enthusiasm about technology is just contagious." And he means it, too. At this school you'd better be willing to adopt all the changes that will be made. When the teachers receive their computers next year, he expects 100% of them to be using them on a daily basis. Those he expects to be comfortable with this? "85%. There's a few who will refuse, but kicking and screaming, will be brought up to speed." He's very impatient with those who try to oppose his vision. When speaking of the central administration who were not in favor of expanding the technology he says," There were some [who refused]. Not any more. I had to change a lot of minds. They have their way, I have mine, we've learned to work together…but they are not in the way anymore." When asked about the support of his local Area Education Agency, he shook his head, "I want to be fair, but ours has been lukewarm because we are not a MAC school. They don't really give us what we need and deserve. For a number of years it's been a rather…strained (grin) relationship. I've had to fight them a lot. But I just kept pushing and they are just starting to come around." This principal, though the vision holder, pushes those around him to share in it. He supports teachers supporting teachers, fostering a mentorship program where teachers are selected to acquire specific technological knowledge, then teach others. The teachers say of him, “Our principal is very supportive, gives us days off to study and arranges lots of inservice. We are given per diem days and a lot of options for technology workshops.”

A number of the teachers are real technology pushers themselves, coming up with new classes and different ways to teach. The students are not the leaders of this technology push.

Money is mentioned as the biggest barrier to technology integration by the principal and the teachers. Because they have so little hardware/software, Palm needs an extensive system of acquisition, which costs money. The principal sees the lack of money as a real lack of support for technology integration, “We tried to pass a bond issue, which failed miserably because the district technology committee wrote that plan four or five years ago and it was very out of date. We’ve set benchmarks for ourselves which we are achieving slowly but surely. We’ve never left our original focus. We just review and adjust as necessary. We are planning on the $300,000 district funds/state technology grant to put a computer on every teacher’s desk. Last year the money went to the elementary school and the year before that a much smaller amount went to put in our lab. The biggest barrier is money. I don’t know where we’d be without the state technology funds.” As one of the teachers sees it, “If we hadn’t gotten state technology money, we’d be in the dark ages.”

Tech support and staff development come under the job description of Palm’s new technology director. And what a job of it he’s doing. It was the technology director who took us on a tour of the school and explained his way of teaching teachers about technology. “it’s all about comfort.” Which is very apparent from his relationships with the staff. He organizes extensive technology workshops covering a large range of technology and comfort levels. He sends out chatty newsletters full of cartoons and simple, step-by-step directions, he's created an entire library of resource material in his office, where teachers are encouraged to drop in and look at manuals or just chat. The amazing thing is, they do! While we were in his office looking at all the aids and notebooks he prepares for teacher in-services, no fewer than three teachers stopped in to chat, borrow more manuals, and check in on the status of a request from a vendor. Not simply a glorified tech support position, the technology director at Palm High school has a Masters in Computer-based learning and helps teachers to research and write curriculum which utilizes technology as an integral part of its make-up. Which makes teachers just love him. Rather than just simply showing them how to plug the machine in, he teaches them how to use it to enhance their own teaching abilities. Realizing that teachers have enough demands on their time, the technology director also previews and helps evaluate software currently available on the market. He says that the AEA does give some suggestions with this, but "since we are not a MAC school, they are not terribly helpful. We just work around them, though they do help with pricing." We were very impressed by the affability of this fellow, who seemed to put teachers at ease while finding real solutions to their technology integration questions. We even earned our very own Mouse licenses. How's that for reward training?

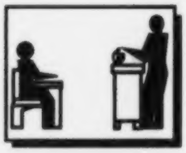
Time, the teacher's traditional greatest demon, did not seem to affect these teacher's enthusiasm for technology advancement. The credit for this seems to belong to the support network of technology director and principal. With the principal's inservice campaign and the technology director's newsletters and extensive training resources, the teachers feel confident they will be able to use their new computers effectively next fall. So time to learn the new technology is not the issue, instead it's, "Scheduling the lab! There's not enough time to explore all I want to do." They know that integration is the end goal of all of this, and their enthusiasm seems to gloss over the time it will take.

Access is key in a school that has such limited resources. Though they suffer from a lack of numbers, they do try to have as many computers available as possible. The open word processing lab is a great idea. It enables students to finish projects on their own time without the need of a personal computer at home, and it gets more students on the computers without having to wait for a lab class. The closed labs are tightly scheduled, and it is almost impossible to get in if you are not in a class. The students find this frustrating, "I don't really use it [the computer] at school, I just go home and do it. I just plan to do everything at home. I find I don't have the time at school. It's O.K. for typing, yeah. But for Internet use, sometimes it's hard to get on." As for e-mail, "we have it, but you have to be in [a class]. The guidance counselor said, "They have it to use on some research under proper supervision, there's been some violations, so they've been restricted." Questioned about access, the principal said, "It's better, but not enough. The more we get, the more we need. Our labs are full all the time. Teachers don't have adequate access. They can go to the labs, but that's before and after school mostly. There are three or four available during the day, but that's impossible to work out." The teachers concur.

The communication in this school seems fairly straight forward. The principal knows what he wants and he lets people know. The teachers can talk with him, but sometimes feel more comfortable going to the technology director. The technology director is a great communicator and keeps everyone informed about technology.

Obviously, the technology director is a great source of information. He looks at all of the things available on the market, collates the information and has it accessible for whoever wants to look at it. He also sends out those chatty newsletters, and holds informal training sessions. But a lot of the information about technology seems to be acquired by those with personal interest. The staff development training seems to have piqued the attention of teachers who are excited to find uses for it in their curriculum. And of course, the principal is out there gathering up gadget brochures and looking for new technology for his school.

Palo Verde High School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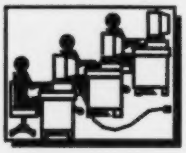

High Tech

Setting

I attempted to find Palo Verde High School in a blinding rainstorm. I had good directions but could barely see beyond the edge of the road. I finally spotted an iron arch over a road leading up the only hill in the area and realized I was finally there.

The school dominated the landscape from its location at the crest of a hill. It was virtually surrounded by farmland. It was not a new building, but well laid out to accommodate all grades. The building was bright and hospitable. There was great rapport among students and faculty. It was a great port in the middle of a storm.

Everyone was very welcoming. As I waited for the high school principal I had the opportunity to visit with the elementary principal. In fact, she asked specifically for this opportunity to share her thoughts about technology.

The administration was very new to this district. The superintendent had been there three years, the secondary principal had been there two years, and the elementary principal had been there one year. They tell me that these are almost records in this district as the turnover rate for administration has been very high in the past.

Everyone I spoke with was very helpful. The administration was very supportive of the use of technology and encouraged their staff to use it appropriately. Repeatedly I heard that technology should not be used just to use technology but should be used appropriately to obtain learner outcomes. This is exciting and the faculty seemed excited about the possibilities.

There appeared to be widespread community support and interest in Palo Verde High School. The superintendent commented, "there is strong community ownership of school. People know what is happening at the school and are interested." The community is well represented on various committees. Communication with parents is a high priority.

I went on the tour first as I was waiting for the other researcher to arrive (which did not happen!). Next I had an interview with the principal, followed by student focus group and teacher focus group. To conclude, I met with both the principal and the superintendent.

Technology

While I don't think they had one computer per student (as Iowa Department of Education statistics indicated), a tour of Palo Verde High School supported records indicating this district as a high technology district. There were two computer labs, a CAD classroom, an ICN room and computers in the media center. The philosophy of the district was to get the technology into the hands of the teachers. Each classroom was equipped with overhead, TV, VCR, and 16mm projector. Though only half of the classrooms have computers at this time, all will be equipped next year.

A new elementary computer lab was just installed. The decision was made to go with PC for the entire school. This lab was not currently connected to the Internet. Installation of this lab included eight hours of staff development, which is a high priority at Palo Verde High School. Every computer in this lab was being used.

The secondary computer lab was a mix of very old Apples and used mostly for word-processing. Plans are to update this lab before next year. No students were in this lab at the time I visited.

Currently only two locations in the school have Internet access. Dial up access was available in the CAD lab and in the library. Plans were in the works to wire the entire school next year. This will provide Internet and phone access in every room.

The ICN classroom was in use when I visited. While they were not on-line, the Spanish teacher was using the technology for presentation. This room is used frequently in this manner.

The district went through a technology assessment in 1996 and developed a technology plan in 1997. They have a strong vision of how they want technology to be incorporated into the classroom. Phase III funds were being used to assist faculty with the purchase of computers but this was tied to a staff development requirement and faculty were required to provide evidence of technology integration.

The superintendent mentioned, “the problem with Phase III is that it is a voluntary staff development plan and that you can’t rely only on this.” He also indicated that there needed to be some incentive for schools that do plan and suggested that the state “provide additional funding to those districts that are doing it right.”

Uses of Technology

The administration was using computers for word-processing and to maintain student records. The offices were networked and using JMC for attendance, grades, health records and some discipline reports.

The principal emphasized the connection between technology purchases and curriculum and materials. Palo Verde High School really supports the idea of using technology "to help teach or to achieve learning outcomes. Technology is the means to the end not just the end. And technology is more than just computers."

Teachers are currently using computer technology for word-processing and research. Many are using videos, laser discs, etc. Some are requiring students to use technology as part of the class. However, others feel pressured by the administration. They feel somewhat forced when they don't really feel ready to expand their uses of technology.

In general, teachers feel that uses of technology will increase as access increases. "It is difficult to plan a lesson requiring students to use the Internet when access is as limited as it currently is."

Students were using technology extensively for the yearbook and for drafting. Other uses included word-processing and research. Surprisingly, none of the students identified email as a major use of technology.

Impact

The principal indicated that technology changes teaching. "It allows us to combine learning modalities in one setting, provide more opportunities and greater interaction between the learner and information." She also felt that there were still some issues to work through. One, secondary teachers are sometimes not very willing to "give up center stage"; and two, those that have equipment feel that "it is in my room and even if I am not using it no one else can."

According to the principal, students also change with the use of technology. The principal felt that "technology is a great tool to help kids become greater problem solvers, to do discovery learning, and also there is logic involved, and good memory." She indicated that it has been the adults that have traditionally held back in the use of technology.

Many teachers indicated that their role has changed as they use technology and some are not happy with that change. “I become a facilitator not just a teacher.” “I have to give something up. The kids are learning more on their own and my role changes. And in some ways I feel pushed aside, no longer needed.” “They don't need me as much as before and they know it.”

Students felt that the use of technology changed how teachers taught. “They have new ideas about how to learn with it.” However, all indicated that there were some teachers that will never use technology and don't want to change.

Students indicated that technology provided more opportunities and allowed access to information. They felt that learning technology skill now prepared them for the future.

Critical Factors

Palo Verde High School has several factors in place promoting the acquisition and integration of technology. First, there is strong administrative leadership in the area of technology. All administrators I spoke with, including the superintendent, secondary principal, and elementary principal, had a clear vision for the integration of technology. They all recognized technology as a tool with the potential to change teaching and learning.

Second, this district has a clear technology plan. It includes not only the acquisition of hardware but staff development and curriculum integration. Palo Verde district has identified the need to not only provide the equipment but provide the training necessary to insure appropriate instructional uses of the equipment.

Third, administration has not limited staff development to only basic technology skills. They continually push for the connection to the curriculum and student outcomes. It is only with this connection that technology use will reach its full potential.

NOTE: As with all research, something unexpected can occur. That's what happened with this site visit. In terms of data collection, what could go wrong, did go wrong. We always sent two researchers to a site, however for this visit the second researcher never made it. In addition, tape recorders were usually used as backup. However, despite double-checking, in this instance the tape recorder did not work. So this case study was based on the reflections of one researcher and the extensive notes taken during the focus groups.

Pine High School

Medium Urban Low Tech

Setting

This community was somewhat of a surprise. It was located just off a major four-lane highway leading to a major metropolitan area. However, it had a distinctly rural feel. Its roots were obviously in small town Iowa but recent housing areas gave the impression that this is a growing community, housing workers commuting to the city for employment.

Pine High School seemed to be a relatively new building surrounded by open areas. We later found out it was almost 20 years old. However, neither the inside or outside reflected this age. Hallways were open and well lit. Classroom areas were separated from more active areas such as music and industrial technology by a large common area.

The atmosphere of Pine High School was positive and everyone we met made us feel welcomed. There appeared to be good rapport among the administration, faculty, and students.

As with many smaller districts, the principal here has many responsibilities. In addition to being secondary principal he is also the K-12 curriculum specialist and the ICN scheduler. Surprisingly, he was not the technology coordinator. This job was given to the computer teacher.

Pine High School has a strong technology committee in place that meets once a month. However this committee does not include any faculty representation other than the computer teacher, nor does it include community representation.

It was interesting to note that one of the goals posted in the office related to technology. It stated, "the learner will possess the skills to effectively integrate changing and emerging technology into his/her life and career.

Technology

Pine High School has two computer labs. Both labs were networked and had Internet access. The PC lab had 18 computers with six in use at the time we visited. It also had a scanner and six printers. The Mac lab had 16 computers and four printers. The Mac lab was empty at the time we were there.

All teachers have computers and access to a printer. About half of these computers are capable of accessing the Internet. Some of the teachers use the computer solely as a management tool while others have it set up for students to use in their classroom

There was an ICN room which was in use when we were there. Several administrators were attending a Universal Service Fund workshop. They have been connected to the ICN for about two years. Currently they originate Spanish classes and receive German classes and plan to increase these offerings next year.

The media center was well equipped with five computers with Internet access. They have an on-line catalog and several databases and reference materials on CD-ROM. The media center was also responsible for taping programs accessed through the satellite downlink. Most of the taped programs related to foreign language or social studies.

The influence of technology was evident throughout the building. The music room had a computerized keyboard, the vocational wing was working with robotics, students in the math classrooms were using graphing calculators, and a student-created video was playing in a Spanish class.

Observation made it appear this was a high technology building, although the Iowa Department of Education statistics indicate a high ratio of students to computers. This observation was supported by comments from the principal, teachers, and students. In addition, the technology plans indicate that this district will continue to move forward with technology.

Uses of Technology

Surprisingly, as well equipped with technology as Pine High School was, we did not observe many innovative uses. Access seems to be the key. Many teachers expressed a desire to integrate technology, however access to computer labs was limited. As with most schools these labs are filled with business and computer classes.

All teachers were doing grades and attendance on computers. Most were doing word-processing and requiring students to use the computer to generate reports. Many had students using a variety of technology for research. In addition, a few were integrating the Internet into their curriculum.

One teacher was using the ICN classroom for student presentations. Students created their reports in PowerPoint and then presented them to their peers. This same teacher was using the Internet to communicate with parents. He posted students grades and parents (or students) could access these with the student ID number. He also “used email every day, created tests with different versions for different sections” and was “dabbling in electronic testing.”

In social studies, the teacher frequently videotapes news events and uses them to supplement the curriculum. "It (technology) allows me to be more current. For example in government class we are studying the Supreme Court. I taped the news last night with a court decision. This is better instead of reading text, more relevant."

The same teacher "use(d) satellite linkup with Japan to study world culture. Also talked to a US senator in DC. This makes learning more meaningful. When a bill was being debated, (we) went to a web site to get the history of the bill."

Impact

The principal of Pine High School felt that technology allowed teachers to stay up to date. "Students can believe that it is real and that teachers are credible and up to date." He indicated that technology allowed teachers to "challenge students in more interesting ways than in the past with color, motion, sound instead of lecture." He felt that technology had a high entertainment value and kept interest high.

The majority of teachers felt that technology changed how and what they taught. As one teacher indicated, "technology makes me more of a helper instead of a lecturer. I can do more things at one time. Technology makes it so we are more flexible, diversity. Even the overhead helps us." Another teacher summed it up; "the bottom line is you are more effective."

However, this change was not without some costs. Several teachers' comments related to an additional time commitment and change in workload. "Learning to use technology takes time, it makes me better, but it takes time." "Some technology is making us work harder. Because things are easy to do we do more than we did before.

Teachers indicated that technology changed how students learned in several ways. One, it served as a motivator. "A handful of lower students are doing better with [technology as a] ‘carrot’. It changes the desire to learn.” Another is the increased opportunities. “Telecommunications allow them to experience things that they wouldn’t have otherwise.” Teachers indicated that technology allowed them to connect their students with “more diverse groups, students from different backgrounds.”

In looking at a vision for the future, a statement from one teacher says it all. “Technology is a means to get knowledge and skills that students are going to need to know. The technology we use may change but the reason we use it will not.”

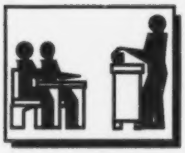
Critical Factors

One major factor influencing technology integration at Pine High School relates to the teachers and their attitudes toward the use of technology. While they recognized the benefits of using technology, they were not sure that they were ready to change or give up their current teaching role. This related to control issues.

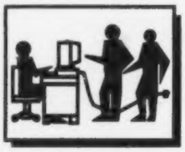
Another factor slowing the integration of technology use is the role of the principal. As he himself identified, he wears many hats. This spreads his expertise too thin to really support the integration of technology.

A third critical factor relates to time. Similar to the principal, teachers in this small district have many responsibilities. This puts demands on what little time they have. The teachers we visited with recognized that learning to use new technology and also learning ways to integrate that technology take time. And time is in short supply.

Plum High School


Medium

Rural 1


Low Tech

Setting

Plum is a small, pleasant town, with shady streets and quiet neighborhoods. The school is very light and airy-seeming, thanks to a recent addition. There are lots of large windows, open areas and light, soothing colors. In the open cafeteria/study hall/lobby area of the school, is a "Wall of Fame", featuring photos of outstanding students. Beneath this is a stand of poster holders which contain photos of the school and student life--sports teams, class photos, clubs, staff photos, awards, etc--dating from the turn of the century to today. There are school spirit posters and activities announcements everywhere. Because of the school's block scheduling (Four 85-minute class periods per day, with alternating schedules), there is not a lot of crowding in the school halls during the day. The large windows and newer, more comfortable desks seem to help control comfort level for these extended time periods. There was also a lot more movement in the classes observed. Rather than sitting for the whole class period, there was more gathering around computers, lab-tables, resource areas, etc.

Technology

This school has some technology, but is anxious to acquire more. They do have an ICN room in which they receive one class (German) and teach one class (Calculus) for broadcast. There are two computer labs in the school. The first has twelve Macs, all connected to the Internet. The second has eighteen of the same. The software in the labs includes: Clarisworks, Netscape, Hypercard and True Basic. At the time of our visit, the first lab was full (class) and the second held fourteen students (another class). The second lab was very dark (all the lights had been turned off) and almost unbearably hot. All the doors were closed and locked.

The school has an Ethernet network connecting the administration and each room in the building. Every room has access to a computer, either a room has its own or shares a computer on a rolling cart with another room. There are three ink jet printers (in the large computer lab) and a laser printer (in the principal's office with free access to teachers and students) networked for the labs and each classroom. The Vocational Agriculture program has four IBMs, Industrial Tech has six Macs and a plotter. The principal has a Power Macintosh. They have a large auditorium with a state-of-the-art computerized lighting system and a sophisticated sound board. TI82 graphing calculators are used in the math classes. The science room contains a bio-chamber (in use) and probes. The principal describes Plum as a "Mac school."

Uses of Technology

Technology at Plum High School is used mainly for word processing and Internet research. There are small islands of other technology use, such as the Vocational Ag and Industrial Tech programs and the ICN room. Presentations are mostly traditional, with only the computer course teacher using the LCD panel in lecture.

An unusual feature of Plum's ICN program is that the teacher of the German course they import is under contract to Plum High, though she does not physically teach there and is under contract with her home school as well.

Future tech plans include the addition of another 20 Mac lab, making laptops available for staff check-out, and acquiring one CD-ROM capable computer for every room (mostly upgrading current equipment). They plan to provide more staff development and technology training, assistance in evaluating technology equipment and software and technical support. They also have plans to "write a curricular plan in every area that utilizes and evolves with technology and other curricular materials."

Impact

Technology seems to be slowly affecting Plum High School. What was once a small rural school focused on traditional community-based job instruction is opening up wider avenues of study for their students.

Though teachers were still a bit leary of it, they seemed to view technology as a support to their teaching rather than a hindrance. In response to our question of how it has changed what they teach, the response was typically, "Active teaching is what we need. Technology is going to help us, but there's no electric machine that's going to take the place of a good teacher." When asked how technology has changed how and what students learn, there were replies both pro and con: "Students now have to be problem solvers and adaptable." "Technology might make them responsible for their own development." "Technology robs a student of his individuality and independence." "They don't read as much. That really disturbs me." "I think we might be fostering life-long learners. There are a lot of people out there who will feel success through the technology."

Students seem to be excited about technology at this school. When asked how technology had affected their learning, students replied, "The net makes it easier to find stuff." "Current information is not available in the library [as opposed to the net]." Their response to our question of how technology has changed the way their teachers teach was, "I don't think our teachers really use it." "Just for grading and stuff."

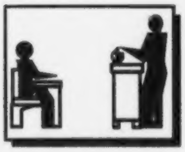
Plum High school is very keen on community involvement. Through their adoption of technology in the school, they have affected the community. More students are now leaving Plum after graduation, and the community, through access to the school's Internet and e-mail services, is more connected to the outside world.

Plum High is going through some technology growing pains. The kids wish that the teachers were more technology savvy, that the school supported a variety of platforms (both Mac and PC), and that there was more access to up-to-date equipment. The teachers seem to have accepted the changes being made, but wish they had more time, training and tech support. The principal is pleased with the progress that has been made, but is looking to expand the technology available and to integrate technology fully into the curriculum.

Critical Factors

There is not a very long history of technology use at this school. The administration has not been adverse to it, but it has not been championed until recently with the coming of the new principal three years ago. Within the technology plan there is a lot of emphasis on the acquisition and/or upgrading of equipment, making more technology training available, and then integration of technology into the curriculum. There is also a focus on teaching students what technology is available in the outside world and the kind of jobs that are coming into existence because of technology. The principal says, "It [the technology plan] is not that well known to a lot of people. I haven't looked at it recently, but it goes along with what I feel. Actually, we're looking to improve our plan with the outcomes of your (Star Schools) study."

Redwood High School



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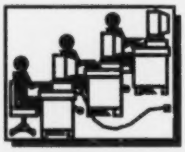
Rural 2



High Tech

Setting

When driving to Redwood High School, we noted that this was a fairly typical Iowa community with a strong agricultural base. The school was easy to locate, sitting a block off the main street.

The Redwood High School building was quite a surprise. While all the facilities were dated, the high school was the oldest and had been built in 1913. A tour of the building showed it to be quite a hodge podge of classrooms and levels. At times it seemed like you couldn't get there from here. It was obvious that the district had attempted to make the rooms inviting, but it was difficult to overcome the restrictions inflicted by the age of the building. People seemed content to work with what they had and it was somewhat amazing that they were able to integrate the technology the way they had.

We were really made to feel at home. All individuals we met (administration, faculty, and students) were friendly and willing to visit. There seemed to be a good rapport between faculty and students. This was a warm and caring place; a nice place to be.

Technology

While Redwood High School building was old, the technology was not. Each classroom was equipped with at least one computer, overhead, TV/VCR, and a phone. Several classrooms were equipped with three or four computers, laser disks or other technology. The hardware was certainly available. However, where they fell short was on software. For example, the social studies classroom had a laser disk player but no laser disks.

The media center had four computers. The card catalog was on-line. It also had a CD-ROM tower for students to access information.

There were two computer labs with Internet access. One lab was used for business classes. It had 20 computers and four printers. In addition, there was a LCD for presentation.

The second lab was used for computer classes and publications. This lab included 20 computers, scanner, digital cameras and printers. Computer classes in Redwood High School included two computer application classes, a multi-media class and a publication class.

Through a unique partnering arrangement, students are able to access a PC lab located downtown. A local business offered daytime use of this lab to the school for only the cost of utilities. The business was only using the lab at night for training purposes.

The district has had an ICN room for several years. They had to build a new building to house this facility. While it does get used, the arrangement with the local college makes it easy for students to take advanced placement classes face-to-face.

Major components of the technology plan include a technology coordinator, networking, and community relations. Redwood School District currently has a quarter-time technology coordinator. This person does a little bit of everything from training to repair. The position is dependent on technology funds being available. There is a strong possibility that this will be a half time position next year.

Plans are in place to network the entire school next year. They have applied for USF but even if that doesn't come through, networking is a high priority.

In terms of community relations, Redwood High School has opened the computer labs to the public in the evening. This started a year ago. Response to date has been low, but they expect this to pick up as they offer mini-courses on use of the Internet to the public.

As part of a consortium of nine schools in the area, Redwood High School has been able to provide a variety of technology-related staff development opportunities. The technology coordinators get together and put together a selection of classes including word-processing, database, Internet, and desktop publishing. Response has been high for the fall offerings but low for the classes offered in February. They are evaluating what changes need to be made.

Uses of Technology

We visited with six teachers. They came from a variety of content areas and all reported heavy use of the computer. As would be expected, the computer teacher and the computer club advisor reported the most diverse use of technology. "I use computers daily for word-processing, multimedia, Internet, research, info trac, access to other catalogs, digital cameras, video. My students created a corporation where they make products and sell them and create a catalog."

Both the social studies teacher and the science teacher reported that they require students to do a lot of research using the computer and Internet. They also mentioned having their students use email to correspond with other schools.

The teachers at Redwood High School are really beginning to integrate the technology. They don't look at it as teaching the skills to use the technology but as incorporating the use of technology to "update the way we have done old assignments." For example, when students "write a book review they turn it into an HTML document and post." Instead of merely typing a research paper students are doing "electronic research papers, HyperCard stuff, neat!"

Students reported a variety of ways they were using technology in their classes. A junior said, "I did a Hyperstudio project of the Grand Canyon. Got the information off the Internet." A senior reported, "I used PowerPoint to give a presentation for business class. I used the templates and displayed it with the LCD panel." Another student was using a spreadsheet to explore nutrition and diet.

Repeatedly students identified with using technology. This use included simple word-processing but also HyperStudio, spreadsheets, Internet research, email. Technology was really being integrated into their classes. They used technology to assist with comparisons in business classes, create music, and to practice their Spanish by using email.

Impact

All those we spoke with at Redwood High School indicated that they felt technology changes both teaching and learning. The principal said the effect on teachers was to "get them away from the front of the classroom. Teachers are doing more facilitating and allowing students to explore.

The teachers agreed. "Utilizing any technology makes something come alive for kids." Another teacher said, "You change your style of teaching so you can use it, changing how you teach, making it more interesting." "They are still learning the same skills" but they are "utilizing a variety of sources."

However, they caution that this change is not without "trade offs". "It takes longer to do the goal so you may not reach other things. Once students have learned how to do it, then other teachers will not have to spend so much time. In elementary school, they are teaching more technology ways of getting information, so those students when we get them, it will be easier to teach them."

Students felt that they benefited from the use of technology. One felt, "We can do more." Another said he could do a "better quality of presentation." Others mentioned the availability, access, and immediacy of information.

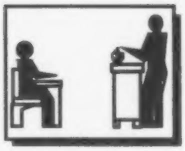
Critical Factors

Redwood High School was well ahead in the integration of technology as compared to the majority of schools we visited. They had a strong technology plan. They recognizing the technology plan as a living document. They did not just write a plan, submit it, and then forget it. They continued to revisit the plan and make adjustments based on changing curriculum needs and technological innovations.

This district also had an administration that firmly supported technology use. They supported the staff with training opportunities. They put technology in labs but also recognized the need for teachers to have access to technology in their classrooms.

The teachers had a positive attitude toward the integration of technology. They recognized the time commitment with changing teaching methodologies. However, they saw technology as motivating for both teachers and learners. Use of technology opened the doors to new opportunities to learn and present.

Spruce High School



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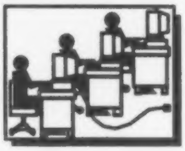
Rural 1



High Tech

Setting

Spruce School District is proud of its heritage and continues with quality rural education and strong family orientation as its foundation. The school district is located approximately 40 miles from a larger town and is surrounded by scenic forests and lakes. Activities in the area are hunting, fishing, and other recreational activities. The town is based on agricultural industry; other employment is sought from area towns.

The town is very small and the focal point of it is the school. When touring the town, it was evident that the town's economy was affected by the inclement weather of too much rain followed by not enough rain. The school building is old but well maintained. Inside, every where you looked you saw a motivating poster enhancing school pride. The floors creaked as you walked across them, but warm friendly smiles greeted you at every corner. You did not feel like a stranger in this school. And for a little of over a dollar, you were treated to a wonderful school lunch.

Technology

This school has one computer for every two students. It is evident in their commitment in providing technological opportunities for their students. The school has three computer labs: DOS lab in the library with 10 computers, Mac lab with ten IIGS and three IIe, and another Mac lab with 10 Power PCs. Every classroom, except for one, has at least one computer. Almost half of the classrooms have a TV and VCR with a TV and VCR available for checkout at the library for the other rooms. Other media available for checkout at the library are 16 mm projector and an opaque projector. The classrooms also are equipped with overhead projectors.

The labs are used for Internet use, home page development, graphing calculators, and content specific software. Most of the software are drill and practice or tutorial. Some of the software are presentational and simulations.

The one technology, besides Internet connection, that is heavily used is the Iowa Communications Network (ICN). As a rural school, it relies on the local community colleges and other school districts to share in more advanced courses. The ICN room is located within 15 feet of the school in a metal building. It is a new facility that is well maintained.

Technology appears to be a priority for this school district. They pride themselves in having a low ratio of student to computers and wishes to increase the variety as well as update the current inventory. Their plan is to put new computers in the elementary and filter that equipment to the middle/high school. Eventually with internal and external funds, the short-term goal is to update the entire school district with current technology and more readily available Internet access.

Uses of Technology

The school sees technology as a learning tool beyond word processing. Their wish is to provide the best quality education with the most current technology. Word processing started the tidal wave but now the school is looking more at what else can be done innovatively. Teachers find technology fun and see the enthusiasm that students portray as they delve deeper into using technology. Not all of the students have computers at home. But those who do are frustrated with the older machines at school and the slow Internet connection. Right now the middle/high school has one Internet connection and is slow because of the current telephone configuration.

Projects students complete using technology range from home pages to resume writing to nutritional analysis. One student used CAD to develop an invention and is currently in the process of patenting the product. The students see endless uses of the computers. They seem to be in fast motion with school hanging on by their coat strings. The students see some teachers as leaders in using technology, and they are not afraid of helping teachers who are reluctant or lack skills in using technology.

With the school being so small, the teaching style has been very different than you would normally find. Teaching is more cross-discipline and more project oriented. For example, with having fewer than five students in a class, the possibilities for the teacher to go beyond drill and practice are nearly endless.

Teachers say when the students get a taste of what could be they just want more. The teachers are finding it hard to keep up with what the students need and want to know.

Impact

Teachers and administrators see the push behind technology and the "need" by students to want more and better technology. Technology opens many doors for students, especially special education students. Teachers are finding that they are teaching faster and the subject matter is becoming more exciting. "It's fun. You get cooperation from them instead of trying to drag stuff out of them." It is easier to teach to different learning styles with technology. Teachers are becoming facilitators and students are becoming more active in their learning.

Teachers are also feeling pressure from the students to go beyond their comfort zone with technology. Students know so much more and are pushing to keep the momentum going. "In general, we have kids that learn how to use them [computers] when they are four or five. If you don't have it when they get to high school, they're gonna say, 'Where's the computer?', you know?"

The roles are often changing with the students teaching the teacher. Being comfortable and open to such a role reversal was universally echoed by the teachers and the students.

Students want more access to information. They relish their school size which enables them to do more in areas of extracurricular activities, where 90% of middle/high school students are involved, but they also want access to courses that larger schools take for granted. Students see the ICN as an equalizer in offering courses in more advanced subject matters. They respect the capabilities of distant learning, but also see that some of the younger students do not see the value of the ICN in enabling them to succeed in courses that were not previously available to them.

With technology being more globally integrated at the elementary level, students do not see the value of them having the technology versus middle/high school having it. Administrators see the big picture and how the technology plan will be best implemented. Students have not connected that the school will be in the long run better to sustain quality technology and quality education.

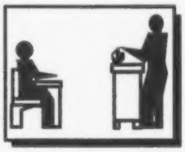
Critical Factors

Critical factors that enable the success of this school district are vision, attitudes, and leadership. The people at Spruce High School know where they want to head with technology. Their technology plan reflects their vision of having a technology rich quality rural education. This vision is reinforced with community support.

Attitudes are positive. Teachers see this as an opportunity to enhance the learning environment. Two of the teachers are working toward degrees in instructional technology. Some teachers are bringing their own computers to school to have students work on projects and to demonstrate software. Also, the teachers are writing grants for external funds in order to pay for their technology needs. The teachers are not waiting for technology to pass them by. They are taking technology head on and wanting to know what else can be done.

Leadership is evident in this school district. It is a shared leadership with strong support from the building principal and leading technology teachers guiding the purchases and policies. Within the building there appears to be a unified goal of providing the best possible education for the students.

Tamarack High School



Small

Rural 2

Low Tech

Setting

This is a pleasant community that is located near a larger metropolitan area. Tamarack School District was difficult to reach because the highways had been renumbered near the town and the road maps were no longer accurate. Interestingly, the final reconstruction of the road had been blocked by the discovery of an important turtle habitat right in the path of the new road!

The school is located in a modern single-story building which has been augmented by the addition of portable classrooms. The school seemed well-used and in some places, too small for the contents. This was particularly true in the computer labs where equipment was placed everywhere there was a flat surface, in the library where old computers were stored and outside the music room in the hallway where all the students left their instruments on the floor.

The day before our visit a number of tornadoes had passed near the area and many people were discussing where they'd been when the tornado passed by. The weather was also threatening on the day of the visit and nearly every classroom had a radio tuned to the weather forecast, just in case. The high humidity and warm temperatures would have made the lack of air-conditioning in the school very uncomfortable if it had not been for the placement of very large fans in the hallways. The fans caused a lot of noise, but the classrooms were comfortable. Intermittent rainfall caused extra excitement as students dashed from the main building outside to the portable classrooms and the ICN.

We ate our lunch in the cafeteria, seated at the "Teachers' Table". It was located in the front corner, near the door where the student council was selling pizza and soda pop in competition with the cafeteria. Judging by the stack of empty pizza boxes (about 30), they were very successful.

The focus groups at this school were smaller than our usual group. Just three teachers were available to meet with us and they were the three who were in charge of promoting technology use. Their responses to our questions were probably not representative of all the teachers in the school. When asked about this they responded "I think most (teachers) are pretty comfortable." "There are just a handful who are not comfortable." "There are not many who don't use it or don't have the kids use it in some fashion."

We also met with a focus group of six students who gave a different view of the teachers. When asked if the teachers know enough about technology, they responded, "Some don't have a clue." "Teachers need a teachers' class [about computers]."

Technology

Tamarack High School has a lot of computers. There are two labs, one a Macintosh lab, and another a PC lab. The Macintosh lab contains 25 computers and all are connected to the Internet. During the visit 16 of these computers were in use. This lab will be replaced this summer with another PC lab and the Macintosh computers will be distributed throughout the school. The PC lab contains 32 computers which are also connected to the Internet – ten were in use at the time of the tour.

Other computers are in classrooms. It is obvious that teachers who are interested in using computers in their rooms are able to acquire them. For example, the Speech classroom has six older computers which students use for word processing, an English classroom has seven computers for student use and the Biology classroom contains four computers, a Scantron, and two printers. Other classrooms contained even more technology: the social studies classroom contained two computers, a laser disk player, a TV/ VCR and two printers. The Science classroom was equipped with two computers, a laser disc player, TV/VCR, microscope camera, and electronic scales. The Math classroom had one computer and a set of graphing calculators. Family and Consumer Science had two computers, two computerized sewing machines with a scanner, and a program for housing design. The Resource Room contains four computers, a scanner, a Braille printer and Braille & Speak. The PE and Music rooms also contain computers and the Band room has a computer which is used to write music on the computer and software to design the marching band program with drill and animation. They also have 4-track synthesizers.

The Media center was remarkable for its lack of technology. It contains one computer for the automated checkout system and one for word processing.

Uses of Technology

According to the technology coordinator at Tamarack High School, 10-12 of the 40 faculty members could be considered high technology users. He believes the rest of the faculty would join in if more funding were available. Students report that they use computers for word processing and some Internet research. Teachers mentioned those as well, but went on to discuss use of scanners, camcorders, laser disk players and graphing calculators. The math teacher spoke of using spreadsheets in Geometry and programming in Advanced Calculus. The Social Studies teacher had not been hooked up to the Internet yet, but was actively using laser disks in class the day of our visit. He described himself as a former technophobe who had "been converted." Students and teachers both mentioned that a number of teachers are beginning to use PowerPoint presentation software to present information in class.

Impact

The most frequently mentioned impact of technology in Tamarack High School was the increased access to current information and the improved speed of acquisition. These were described by the principal, teachers and students alike.

The school does have an ICN room and a physics class is taught from there. They would like to offer more classes and use the ICN more.

Critical Factors

The Tamarack School District's Technology Plan focuses on the period from 1996 to 2001. It describes a number of actions the school district will take. Some of these involve educating community members and providing access to information through the school district. The plan also describes a number of technology competencies that teachers are expected to develop. The competencies are divided into three levels with one year provided for the acquisition of each set of skills. Teachers are now in the second year of developing these competencies and the goals set for this level are:

- To be able to install software,
- To troubleshoot software conflicts
- To connect and use peripheral technologies
- To be able to integrate technology into classroom instruction
- To be able to use multimedia tools to enhance the delivery of instruction
- To read about educational technology.

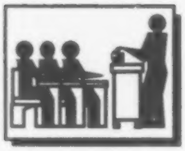
There are no plans at this time to evaluate whether or not the competencies have been achieved.

Staff development is a critical factor in all districts. The plan also includes a section on staff development needs to enable teachers to accomplish these goals. However, it quickly turns to the processes of developing a computer curriculum, providing access to district financial information and obtaining grade book and attendance software. In Tamarack School District staff development is largely accomplished by offering computer classes and by allowing teachers to attend workshops and conferences outside of the district and then having them share information when they return.

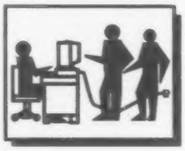
Access to technology is a factor in many schools but does not appear to be a problem in Tamarack High School. Students, teachers and the principal agree that both teachers and students have adequate access to technology.

Funding was a factor mentioned frequently at this school. They have some big plans and hope that funding will be adequate. One impact of lack of funding is the continued use of printers that are up to ten years old. These suffer frequent breakdowns and will be replaced when funds are available.

Walnut High School


Large

Urban


Low Tech

Setting

This sprawling, single-story brick school building is framed by cornfields and a highway. The students who attend Walnut School come from a variety of nearby towns.

The building has lots of large windows looking out over the rural landscape, making the interior bright and giving a very spacious feel. The halls are clean and wide, the classrooms are large and brightly decorated. We were welcomed warmly by the principal and the secretarial staff.

Technology

There is a computer in every classroom at Walnut School. Three color printers are available via the network, and each classroom has a standard printer.

The main computer lab has 22 computers, all of which have access to the Internet. The library computer lab has 24 computers and the Media Center has five computers, with Electric Library available for the students and faculty.

The well-equipped Industrial Technology classroom has 12 computers, two of which are connected to the Internet. Industrial Technology students also have access to three computer numeric control (CNC) lathes with CadCam software and AutoCad 13 software. The students design and write programs for the machines.

Other technology observed includes a digital still camera, video cameras and monitors, digital scanner, multi-scan projector, overhead projector, and 16 mm film projectors.

Each classroom is equipped with a TV monitor, used primarily for Channel One.

Uses of Technology

In Vocational Agriculture, students use satellite technology to keep an eye on the markets and weather, and the Internet is used extensively for research. The instructor makes use of the classroom's TV/VCR for PowerPoint presentations, and a laser disc player is used for cooperative learning situations.

The math department owns 15 TI92 graphing calculators, and projects the output on the wall for the students. The students use the graphing calculators in an exploratory manner, often working together in pairs on more difficult problems.

The ICN room has been in place for one year and is heavily used. Teachers are encouraged to use the ICN room for presentation purposes, and are using the available technology regularly. A number of students are taking AP classes via the ICN, and three teachers are taking college courses. The ICN classroom is in use just about every period during the school day.

The drama classroom has a video camera in the back of the room that is used for recording performances, creating TV news segments, and making commercials.

Impact

"We think we're on the cutting edge, but we have to get the kids more involved," says the principal of Walnut School.

The students at this school have been exposed to a wide range of educational technology, and they are eager for more. One student says he would like to learn more about advanced html. Another student said "I'd like to see more classes offered in the ICN room, like other languages – languages we can't get here like French or German."

Most of the students at Walnut High School were exposed to technology when they were in fourth or fifth grade, so they are comfortable with computers. They are familiar with a variety of tool software, and comfortable with exploring new avenues with technology.

Five of the seven 10th and 11th grade students we talked with have computers at home, three of those have an Internet connection at home. The students believe their home computer access is representative of the student body as a whole, which may be why they do not think there is a problem with access to computers at school.

Critical Factors

There is a lot of community support for the school, evidenced by a ten year Instructional Support Levy that was passed about six years ago. The levy was designed to get the school out of debt, buy new textbooks, and purchase technology.

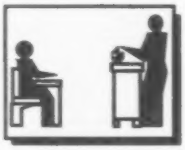
"We have computers galore here" according to the principal. "Seven years ago there was one Mac Classic in the building", according to the school's network coordinator. Now there is a computer in every classroom, as well as two well-equipped computer labs.

Walnut School's approach was to give teachers computers first. The early emphasis was on extensive staff development. Everyone got the basic training, then a few teachers got specialized training and we asked to train their peers. After the teachers had a chance to learn the technology, then the computer labs were built.

By starting with the teachers, Walnut school was able to make sure the technology that was purchased would be used. By getting the teachers comfortable first, there was an opportunity to learn the hardware/software, and think about how to integrate it into the curriculum.

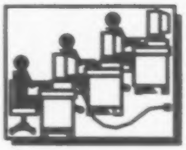
The Network Coordinator is a dynamo. She's knowledgeable and enthusiastic about technology, but her real strength is her communication skills. She is liked and respected by her fellow teachers, and is generous with her time and information. She makes technology comfortable for the teachers, and encourages them to try new things.

Willow High School



Small

Rural 2



High Tech

Setting

Willow High School is housed in an old three-story building which has a more recent addition. The recent addition houses the office of the superintendent and the gymnasium. The school building contains the entire school district with the Elementary school mostly in the daylight basement floor, the middle school on the second floor and the high school primarily on the third floor. As we toured the school, it became obvious that the school had undergone a number of renovations, leaving oddly placed staircases and uneven hallways behind. The media center is located in the middle of the second floor and services all students. It looks recently renovated and is a very pleasant area with large windows to admit the daylight.

The day of the visit we were surprised to find the principal had been called away to attend a conference, but the superintendent was available to answer our questions and give us a tour of the school.

We took our lunch in the teachers' lounge and were able to chat with several of the staff members. They were interested in technology but expressed some strong reservations about the impact of computer use on students. The strongest voice, a former PE teacher, suggested that the computer was too seductive and students would spend as much time on the Internet as they do with video games. The speaker was not suggesting that students avoid computers, but that they have access to lots of outdoor activities as well.

The Willow High School visit took place after our visit to their supporting Area Education Agency. During the AEA visit we were advised that Willow High School

District had undergone great changes in leadership, losing a number of personnel who were already trained to use technology. The AEA technology coordinator was concerned about the school and was trying to devise new ways of delivering training and certifying competency for the new staff members. According to the technology coordinator, this school had been well on the way to integrating technology before the disruption.

As we met with the superintendent, toured the school and conducted the student focus group, the change in staff was alluded to, but not seen as a great barrier. During the teacher focus group, however, it became obvious to the researchers that the teachers were wary of technology, distrustful of administration, and not willing to take risks or go beyond their classroom responsibilities. At the end of the teacher focus group, the tape recorder was turned off and another question was asked of the teachers. The teacher responses revealed that the loss of staff the prior year was due to scandal on the part of some, misuse of funds by another, and the departure of the district technology coordinator was mourned by none.

Another issue mentioned by the teachers was the decision to switch to a block schedule. They agreed to this change, the teachers said, because the new schedule offered them more planning time. This planning time was taken away after the new schedule was adopted. These issues will surface in teacher attitudes throughout this case study, the net effect being that in this school there is no trust between the teachers and the administrators.

Technology

Willow School District initially adopted the Macintosh platform for student, teacher, and administrators. The school building was networked for Macintoshes and training was provided to students and teachers. This year, the new superintendent, supported by a number of teachers and community members, decided the students should have access to both platforms. The superintendent wanted a computer that "would link to the Department of Education for certified enrollment and submission of the budget." Teachers and students recognized that most of the computers in the workplace would be IBM compatibles and deemed it only reasonable for students to learn that platform. One teacher commented on barriers to technology integration saying, "I was trained on IBM, but we have Macs in our rooms. Relearning the word processor was the hardest thing." Three of the five students interviewed commented on the difference in platforms as well. One said, "I write my papers at home because I have an easier program at home– I have a PC at home." Another said, "I have an IBM at home, I really don't like Mac." And yet another student offered, "They have Macs here and I don't like typing on them."

The final decision was to use the Macintoshes mainly in the Elementary and Middle Schools and the IBM compatibles in the High School. This caused some friction with the AEA and the superintendent characterized this as "Talking technology platform choice is like talking religion. They (the AEA) seemed to say, "How dare they switch from Mac to PC and rewire the network?"

Willow High School currently has 53 Macintosh computers, including one computer in each classroom. One of these has been given to the media center because the teacher preferred to use a PC in the classroom.

The media center has five Macintosh computers, which are available for student use. Three of these are older machines and the newer ones were machines refused by a teacher and the kitchen staff. The two newer Macs were connected to the Internet for student use. The on-line card catalog is housed on two IBM computers.

There are two computer labs in Willow High School, each contain 20 PCs plus a Macintosh computer for teacher use. One of the labs is used for the yearbook class, to teach a PASCAL programming course, Internet access, and keyboarding class. At the time of the walk-through 10 of the computers were in use by 21 students. The other lab was not in use during the visit. It contains older computers and one teacher commented that " The Junior High computer class went 10 weeks without computers. They were broken." Willow High School does not have a support technician, but contracts that work out to local suppliers.

Televisions and VCRs were in common use and a number of overhead projectors were also observed in classrooms and computer labs. The biology classroom was equipped with a FlexCam for use with a microscope, three cameras, a TV and a VCR. The math classroom used graphing calculators and was equipped with presentation hardware and software.

The art class had a computer and a kiln and was watching a video during the tour. The special education classroom was equipped with four computers, but none were in use. The walk-through took place at 2 pm.

Uses of Technology

All of the teachers and students we interviewed reported using the Internet for research. Some of them reported using the Internet at school and some at home. The classroom computers are not being used to present lessons at this time. Outside of the Internet, the typical technology usage at Willow High School is as a tool to accomplish specific tasks – yearbook, grades, attendance, or as a piece of curriculum in the computer programming and keyboarding classes. All of the students interviewed said they wrote their papers at home.

In science and math teachers are beginning to take advantage of new technologies to present information in different ways. The day of the visit was the day the math teacher unpacked his new graphing calculators and the projection device that supports them. Another teacher reported ordering new equipment when the school board gave him funds for that purpose, but more than half of the funding "disappeared" before he could obligate it. Students are allowed to use the computer in his room for Internet searches related to science, but it gets little use otherwise. Despite his disappointment and distrust, this teacher views technology positively saying, " Technology allows me to do something I couldn't do otherwise, like show how the circulatory system works by hooking up EKG sensors.... [Using FlexCams] I can show kids what they are looking for, teach observing skills."

It is unclear where the vision for technology use comes from in this school. The superintendent supports technology use, but still sees it as a way of motivating students. Teachers look to technology to enable them to do more in less time, expand sources of current information, and make the school to work transition smoother. The community seems to support the integration of technology into the school; the Boosters' club donated some printers to the school and is working on more contributions.

The superintendent and teachers are very positive about the future of technology. The superintendent commented, "Small schools realize their niche is to stay abreast of technology as an equalizer." Teachers believe that five to ten years into the future technology will be "natural, common place" and will offer more opportunities for students to expand their educational choices. Students will be "...using the Internet alone, just log on via the Internet for any class." Also, "The ICN will provide wider educational opportunities." However, some voiced the need for caution, " I hope they will spend more time at school, less time at home." "Our kids will be so focused and limited, they will have no social interaction."

Impact

Technology seems to have had an impact on this school mostly in the form of increased access to knowledge. One student commented, "It changes the rate you can learn. It gives you incredible access." Another said, " The library is not able to keep up or to get everything we need. The Internet gives us access to a lot more information." Teachers repeat this saying, "We have much more up-to-date information. The encyclopedia still talks about East and West Germany."

Critical Factors

Willow High School has computer labs that are ten years old. They began modernizing their technology program in 1995. First they concentrated on building the infrastructure, and in 1996-1997 they added a Macintosh computer for each teacher. As mentioned earlier, a combination of circumstances and events resulted in a change to the PC platform, loss of trust between teachers and administration and friction with the Area Education Agency. This school is mired in several conflicts which are hampering the integration of technology.

The technology plan is another source of tension. Although the superintendent said it was written by a K-12 contingent of teachers and non-certified personnel, the teachers interviewed said, "I haven't seen the tech plan.", "The plan wasn't shared with us." "It was last revised two or three years ago." "The Macs in our rooms are part of that plan." The former technology coordinator was also criticized, "Last year the tech coordinator asked for input, but it (teacher input) was not considered when purchasing."

Staff development is another area that greatly influences the integration of technology. At Willow High School six technology training sessions were offered this year. All were one or two hour sessions dealing with specific software programs including: Norton Utilities, Claris Word Processing, and KidPix Studio. Between six and 30 staff members attended the sessions.

Teacher comments included, "Staff development has been minimal. Teachers want more, especially with (teacher named)"and "Once they know how to run it, teachers will use it."

Colleagues were considered a good source of information, as was the new technology coordinator, the Area Education Agency, and catalogs. Another teacher offered, "I don't look for new information."

This small school has found funding sources outside of the regular budget by requesting support from local merchants and corporations. They have received both hardware and software from these sources and continue to develop those relationships.

APPENDIX D:

CODING CATEGORIES

Coding Categories

School Characteristics
School Characteristics/District Size
School Characteristics/District Size/Large District
School Characteristics/District Size/Small District
School Characteristics/District Size/Medium District

School Characteristics/Technology level
School Characteristics/Technology level/Low technology
School Characteristics/Technology level/High technology

School Characteristics/Rural-Urban
School Characteristics/Rural-Urban/R2
School Characteristics/Rural-Urban/Urban
School Characteristics/Rural-Urban/R1

Individual Characteristics
Individual Characteristics/Job Title
Individual Characteristics/Job Title/Superintendent
Individual Characteristics/Job Title/Principal
Individual Characteristics/Job Title/Teacher
Individual Characteristics/Job Title/Student
Individual Characteristics/Job Title/Technology Coordinator
Individual Characteristics/Job Title/Media Specialist

Individual Characteristics/Gender
Individual Characteristics/Gender/female
Individual Characteristics/Gender/male

Individual Characteristics/Computer at Home
Individual Characteristics/Computer at Home/Yes computer
Individual Characteristics/Computer at Home/No Computer

Individual Characteristics/Internet at Home
Individual Characteristics/Internet at Home/Yes Internet
Individual Characteristics/Internet at Home/No Internet

Individual Characteristics/SUBJECT AREA 1
Individual Characteristics/SUBJECT AREA 1/English

Individual Characteristics/SUBJECT AREA 1/Sciences
Individual Characteristics/SUBJECT AREA 1/French
Individual Characteristics/SUBJECT AREA 1/FACS
Individual Characteristics/SUBJECT AREA 1/Business Ed.
Individual Characteristics/SUBJECT AREA 1/Math
Individual Characteristics/SUBJECT AREA 1/Resource/Special Ed.
Individual Characteristics/SUBJECT AREA 1/Library Media Specialist
Individual Characteristics/SUBJECT AREA 1/Government
Individual Characteristics/SUBJECT AREA 1/Resource/Special Ed..
Individual Characteristics/SUBJECT AREA 1/Music
Individual Characteristics/SUBJECT AREA 1/Vocational Technology
Individual Characteristics/SUBJECT AREA 1/Art
Individual Characteristics/SUBJECT AREA 1/Guidance
Individual Characteristics/SUBJECT AREA 1/Library Media Specialist
Individual Characteristics/SUBJECT AREA 1/History
Individual Characteristics/SUBJECT AREA 1/Spanish
Individual Characteristics/SUBJECT AREA 1/Social Studies
Individual Characteristics/SUBJECT AREA 1/Vocational Technology
Individual Characteristics/SUBJECT AREA 1/Business Ed. / Computers
Individual Characteristics/SUBJECT AREA 1/German
Individual Characteristics/SUBJECT AREA 1/PE
Individual Characteristics/SUBJECT AREA 1/Jr High
Individual Characteristics/SUBJECT AREA 1/attendance center
Individual Characteristics/SUBJECT AREA 1/Health
Individual Characteristics/SUBJECT AREA 1/Business Ed/ Computers

Vision
Vision/Lack of Vision / Vision/Limited Vision
Vision/Well Defined Vision / Vision/Inventive Vision

Access
Access/No Access
Access/Limited Access
Access/Adequate Access

Innovative Uses of Technology
Innovative Uses of Technology/Innovative Project
Innovative Uses of Technology/Innovative Partnership
Innovative Uses of Technology/Innovative Classroom
Innovative Uses of Technology/Innovative Use Outside Classroom

Impact
Impact/Positive Impact
Impact/Negative Impact
Impact/Unanticipated Impact

Actors
Actors/Principal
Actors/Teacher
Actors/Student
Actors/Technology Coordinator
Actors/Superintendent

About Actors
About Actors/About Principal
About Actors/About Teachers
About Actors/About Students
About Actors/About Technology Coordinator
About Actors/About Superintendent
About Actors/About AEA
About Actors/About School Board
About Actors/About Booster Club

Barriers
Barriers/Training
Barriers/time
Barriers/money

Questions
Questions/*AEA Support
Questions/*Anything Else
Questions/*Integration of Technology
Questions/*Motivation
Questions/*Notes
Questions/Role of Expert
Questions/*Role of Technology Person
Questions/*Sources of Information
Questions/*Student Change
Questions/*Support and Evaluation
Questions/*Teacher Change
Questions/*Technology Desires
Questions/*Technology Plan Impact
Questions/*Technology Use
Questions/*Vision

Free Nodes
Free Nodes/Dissatisfaction
Free Nodes/Misconception
Free Nodes/Attitudes

Free Nodes/Tech Non-Use
Free Nodes/Leadership
Free Nodes/Tech Plan
Free Nodes/ICN
Free Nodes/internet use
Free Nodes/Technology Desires

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